M67386.AR.000128
MCRCO KANSAS CITY
5090.3a

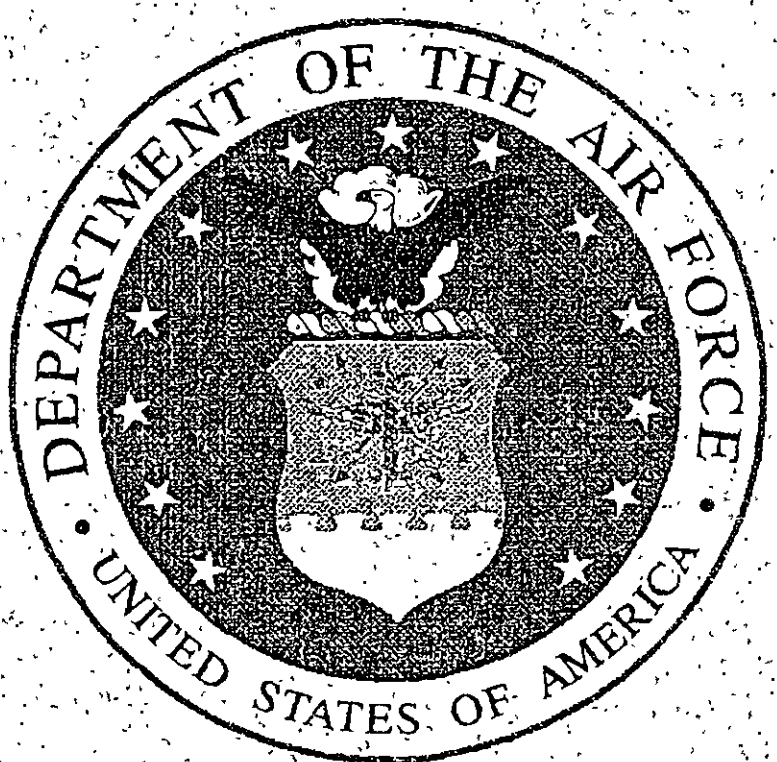
FINAL TECHNICAL REPORT PRELIMINARY ASSESSMENT/SITE INSPECTION OF SITE SS009 WITH TRANSMITTAL LETTER KANSAS CITY MO
9/29/1995
TETRA TECH

INSTALLATION RESTORATION PROGRAM (IRP)

PRELIMINARY ASSESSMENT/SITE INSPECTION OF IRP SITE SS009 RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

FINAL

TECHNICAL REPORT



29 September 1995

DEPARTMENT OF THE AIR FORCE
AIR FORCE BASE CONVERSION AGENCY

11OCT95R DOC

17-Nov-95

MEMORANDUM FOR MISSOURI DEPARTMENT OF NATURAL RESOUCES (MDNR)
ATTN MR GLENN GOLSON

FROM Operating Location Q, AFBCA
15471 Hangar Road
Kansas City, MO 64147-1220

SUBJECT: Final Preliminary Assessment/Site Inspection (PA/SI) for the Installation Restoration Program (IRP) Site, Fire Valve Area - SS009

1 Thank you for the MDNR comments provided in your 11 Oct 95 letter, on the draft final report titled *Preliminary Assessment/Site Inspection of IRP site SS009, Richards-Gebaur AFB, MO.* Attached are the requested copies of the final report

2 The contract between the Air Force Center for Environmental Excellence and Tetra Tech Inc has expired Due to this event, I am unable to further task Tetra Tech with responding to the additional concerns of MDNR In order to respond to the additional concerns, I have added this cover letter to the report, which identifies the outstanding concerns the Missouri Department of Natural Resources has expressed with this Final PA/SI.

a The Missouri Department of Natural Resources is concerned that the "contamination in [soil boring] FSB8 is not directly addressed" within the report; and that source for this contamination appears to be not associated with activities near this site, and "strongly suggests" further evaluation of the area as a separate site.

Response: The PA/SI does not discuss the detected compounds in this soil boring because the compounds did not appear to be related to the contamination found at IRP site SS009, and the detected compounds ranged from 150,000 times to 1.6 million times lower than the proposed "Any Use Levels" developed by the Missouri Department of Health for residential settings (Proposed Rule 19CSR20-9 020) Due to the shallow depth of the sample (2½ feet), the source may have been a small unreportable gasoline spill on the parking lot (when gravel) some years ago Three other soil borings around FSB8 did not indicate presence of any contamination The environmental specialists I have contacted within the Air Force do not presently share the Missouri Department of Natural Resources' concern over FSB8 sample results

b The Missouri Department of Natural Resources is concerned that the ingestion pathway for fish consumption from Longview Lake or ponds along Scope Creek were not assessed within this PA/SI

Response: Environmental specialists within the Air Force presently do not share the Missouri Department of Natural Resources' synopsis, "the ingestion pathway for fish consumption from Longview Lake or ponds along Scope Creek were not assessed within the report " The report fully assessed this pathway in section 3 1 4, on pages 36-37, in accordance with the requirements in 40 CFR 300. The surface water exposure pathway is considered incomplete, therefore, site contaminants are not available for fish downstream of the site

2 I can be reached at (816) 348-2511, x28 if you have any questions about the final PA/SI report.

P MARK ESCH
BRAC Environmental Coordinator

1 Atch
Final Preliminary Assessment/Site Inspection of IRP site SS009

cc:
1. EPA (Bob Koke)
2. MDNR (Bob Geller)
3 AFCEE (Fred Waterman)

INSTALLATION RESTORATION PROGRAM (IRP)

FINAL

TECHNICAL REPORT

FOR

PRELIMINARY ASSESSMENT/SITE INSPECTION OF IRP SITE SS009 RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

Prepared By:

Tetra Tech, Inc.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Submitted By:

Air Force Center for Environmental Excellence
Mr. Fred Waterman
Contracting Officers Representative

Prepared For:

Air Force Base Conversion Agency
Richards-Gebaur Air Force Base

29 September 1995

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1 AGENCY USE ONLY (Leave Blank)	2 REPORT DATE	3 REPORT TYPE AND DATES COVERED
	29 September 1995	Final

4 TITLE AND SUBTITLE

Final Technical Report
Fire Valve Area, IRP Site SS009, Richards-Gebaur Air Force Base, Missouri

5 FUNDING NUMBERS

USAF Contract No.
F33615-90-D-4006

6 AUTHOR(S)

Tetra Tech, Inc.

7 PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Tetra Tech, Inc.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103

8 PERFORMING ORGANIZATION REPORT NUMBER

N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Center for Environmental Excellence
Environmental Services Office
Base Closure Restoration Division (AFCEE/ESB)
Brooks Air Force Base, Texas 78235-5328

10 SPONSORING/MONITORING AGENCY REPORT NUMBER
SPONSORING/MONITORING AGENCY REPORT NUMBER

N/A

11 SUPPLEMENTARY NOTES

12a DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release. Distribution is Unlimited.

12b DISTRIBUTION CODE

13 ABSTRACT *(Maximum 200 words)*

This document presents the results of the Preliminary Assessment/Site Inspection of the Fire Valve Area, IRP Site SS009, at Richards-Gebaur Air Force Base, MO.

14 SUBJECT TERMS

Final Technical Report

15 NUMBER OF PAGES

16 PRICE CODE

17 SECURITY CLASSIFICATION OF REPORT	18 SECURITY CLASSIFICATION OF THIS PAGE	19 SECURITY CLASSIFICATION OF ABSTRACT	20 LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01 280-5500 Standard Form 298 (Rev 2-89)

NOTICE

This report has been prepared for the United States Air Force by Tetra Tech, Inc. to provide information regarding environmental conditions with respect to possible releases of hazardous substances at Richards-Gebaur Air Force Base (AFB), located in Cass and Jackson counties, Missouri. As the report relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on future investigations or remedial actions may be in the public's interest. The limited objectives of this report and the ongoing nature of the studies at Richards-Gebaur AFB, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report, since subsequent facts may become known which may make this report premature or inaccurate. Acceptance of this report in the performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations, or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

Government agencies and their contractors registered with the Defense Technical Information Center (DTIC) should direct their requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, VA 22304-6145

Non-government agencies may purchase copies of this document from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161

PREFACE

Tetra Tech, Inc. is the contractor for the Preliminary Assessment/Site Inspection (PA/SI) of IRP Site SS009 at Richards-Gebaur Air Force Base, Missouri. This work has been performed for the Air Force Center for Environmental Excellence (AFCEE), F33615-90-D-4006, Delivery Order 0008. This Technical Report describes activities that took place during the PA/SI of IRP Site SS009 at Richards-Gebaur Air Force Base.

Principal Tetra Tech personnel include Mr. Russell B. Krohn, who serves as Project Manager; Julie WestHoff, who serves as IRP Site SS009 Task Manager; and Dr. Garabed Kassakhian, who serves as Project Quality Assurance/Quality Control (QA/QC) Manager.

The activities described herein were accomplished between September 1993 and June 1995. Ms. Wilhelmina Butcher, Air Force Center for Environmental Excellence, Base Closure Restoration Division (AFCEE/ERB), was the Technical Project Manager through April 1995. She has been replaced by Mr. Fred Waterman.

EXECUTIVE SUMMARY

This is the Technical Report for the Preliminary Assessment/Site Inspection (PA/SI) of Installation Restoration Program (IRP) Site SS009 at Richards-Gebaur Air Force Base, Missouri. This document describes the activities conducted during the PA/SI of IRP Site SS009, also known as the Fire Valve Area. The investigation of the Fire Valve Area included a literature search to obtain background information; investigating the source of contamination and whether contaminated soils remained in the Fire Valve Area; developing a conceptual site model to illustrate the contamination and evaluate the current and future potential risk posed by the site to public health and the environment; and determining whether further action is required at the site.

Based on the findings of the investigation, the source of the petroleum contamination in the Fire Valve Area appears to be related to a spill or release, possibly from past operations in Building 605. Contamination was not observed in the borings surrounding the original excavation of the Fire Valve Area; however, petroleum contamination was observed in soils along the water line trench in the area west of Building 605. The major contaminant found in the subsurface is total petroleum hydrocarbons (TPH) ranging in concentration from 18 ppm to 370 ppm. Ethylbenzene and xylene compounds were detected at concentrations less than 0.1 ppm, and non-carcinogenic polynuclear aromatic hydrocarbons (PAHs) were detected at 1.1 ppm.

There are no Federal criteria or standards for contaminated soils; however, the State of Missouri has established soil cleanup levels for ethylbenzene, xylene, and TPH that are associated with spills from Underground Storage Tank (UST) systems and are considered relevant to the site. Only one soil sample exceeded the State of Missouri's cleanup level of 200 ppm for TPH and the sample was from 4.5 feet below ground surface. None of the samples collected exceeded Missouri's cleanup levels for ethylbenzene and xylene compounds (10 ppm for each compound) or Missouri's proposed Any-Use Soil Level for the PAH compounds (19,530 ppm).

A conceptual site model of current and potential exposures was completed which evaluated potential risk associated with the site. The potential receptors identified through the qualitative risk assessment were utility workers conducting maintenance along the water line; however, their risk would be minimal as the major contaminant of concern was TPH and maintenance on the line would be intermittent, occurring on an as-needed basis.

Based on the results of the PA/SI, the soils do not require further investigation and a No Further Response Action with respect to the soils is proposed for the Fire Valve Area. However, the groundwater underlying the site was not investigated as part of the PA/SI, and further action is recommended to determine whether the groundwater has been affected by the contamination identified during the PA/SI.

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

List of Figures

List of Tables

List of Appendices

LIST OF ACRONYMS

ADC	Air Defense Command
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFCS	Air Force Communications Service
AFRES	Air Force Reserve
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CLP	Contract Laboratory Program
CWA	Clean Water Act
DQOs	Data Quality Objectives
EPA	Environmental Protection Agency
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrophotometer
gpm	Gallons per minute
GSA	Government Services Administration
HMTA	Hazardous Materials Transportation Act
IDW	Investigation Derived Waste
i.d.	Inside Diameter
IRP	Installation Restoration Program
ITIR	Informal Technical Information Report
LCS	Laboratory Control Sample
LNAPLs	Light Non-aqueous Phase Liquids
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	Method Detection Limit
MDNR	Missouri Department of Natural Resources
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollution Discharge Elimination System
o.d.	Outside Diameter
PAH	Polynuclear Aromatic Hydrocarbons
POC	Point of Contact
POL	Petroleum, Oil, Lubricant
PQL	Permissible Quantitation Limit
PPE	Personal Protective Equipment
PPM	Parts per million
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act

LIST OF ACRONYMS
(Continued)

RI	Remedial Investigation
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOW	Statement of Work
SVOCs	Semi-volatile organic compounds
SWDA	Solid Waste Disposal Act
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This is the Technical Report for the Preliminary Assessment/Site Inspection (PA/SI) of Installation Restoration Program (IRP) Site SS009 at Richards-Gebaur Air Force Base (AFB), Missouri Provided in this document are the results of the activities conducted during the PA/SI of IRP Site SS009, also known as the Fire Valve Area. The investigation of the Fire Valve Area involved a literature search to obtain background information, field investigations to determine whether contamination remained in the Fire Valve Area and the source of that contamination, development of a conceptual site model, and completing a qualitative risk assessment to estimate the potential risk posed by the site to public health and the environment.

Richards-Gebaur AFB is an Air Force Reserve Base located in west-central Missouri, approximately 18 miles south of downtown Kansas City and 2.6 miles from the Kansas State line (Figure 1.0-1). The Fire Valve Area, Site SS009, is located at the edge of the Civil Engineering Complex, directly behind (southwest side) Building 605 (Figure 1.0-2). During excavation by an Air Force contractor in March 1992 to repair an underground water main valve, petroleum product was discovered. The soils from the excavated trench were tested and contaminant levels exceeded the State of Missouri's cleanup levels for benzene/toluene/ethylbenzene/xylene (BTEX) and total petroleum hydrocarbons (TPH). Approximately 10 cubic yards of soil were removed and the excavation was backfilled with clean fill. Determining the source of the petroleum contamination in the Fire Valve Area and whether contaminated soils remained in the Fire Valve Area were the objectives of this PA/SI.

Soil borings were drilled and sampled during the PA/SI to determine the presence of contaminants in the soils. Field screening of the volatile organic compounds (VOCs), specifically BTEX, in the soils was accomplished by use of a portable gas chromatograph (GC). The GC results were used to aid in the selection of samples for detailed laboratory analyses. Field activities occurred 24 and 25 March, and 28 through 30 March 1994.

The information in this Technical Report was prepared according to applicable sections (refer to Appendix N) of the May 1991 version of the Handbook to Support the Installation Restoration Program (IRP) Statements of Work, Volume I-Remedial Investigation/Feasibility Studies (RI/FS) (U.S. Air Force 1991) (hereinafter referred to as the Handbook); the U S. EPA Guidance for Performing Preliminary Assessments Under CERCLA (P9345 0-01A, September 1991); and Guidance for Performing Site Inspections Under CERCLA (EPA/540-R-92-021, September 1992).

This Technical Report is divided into five sections. This section (Section 1.0) discusses the purpose and scope of the PA/SI, as well as providing background information (e.g., soils, geology, etc.) about Richards-Gebaur AFB and the Fire Valve Area. Section 2.0 presents the field activities and laboratory analyses. Section 3.0 discusses potential migration pathways for contaminants including potential targets. Section 4.0 contains the risk evaluation, identifies potential applicable, relevant and appropriate requirements (ARARs), and presents a conceptual site model. The summary and conclusions are provided in Section 5.0.

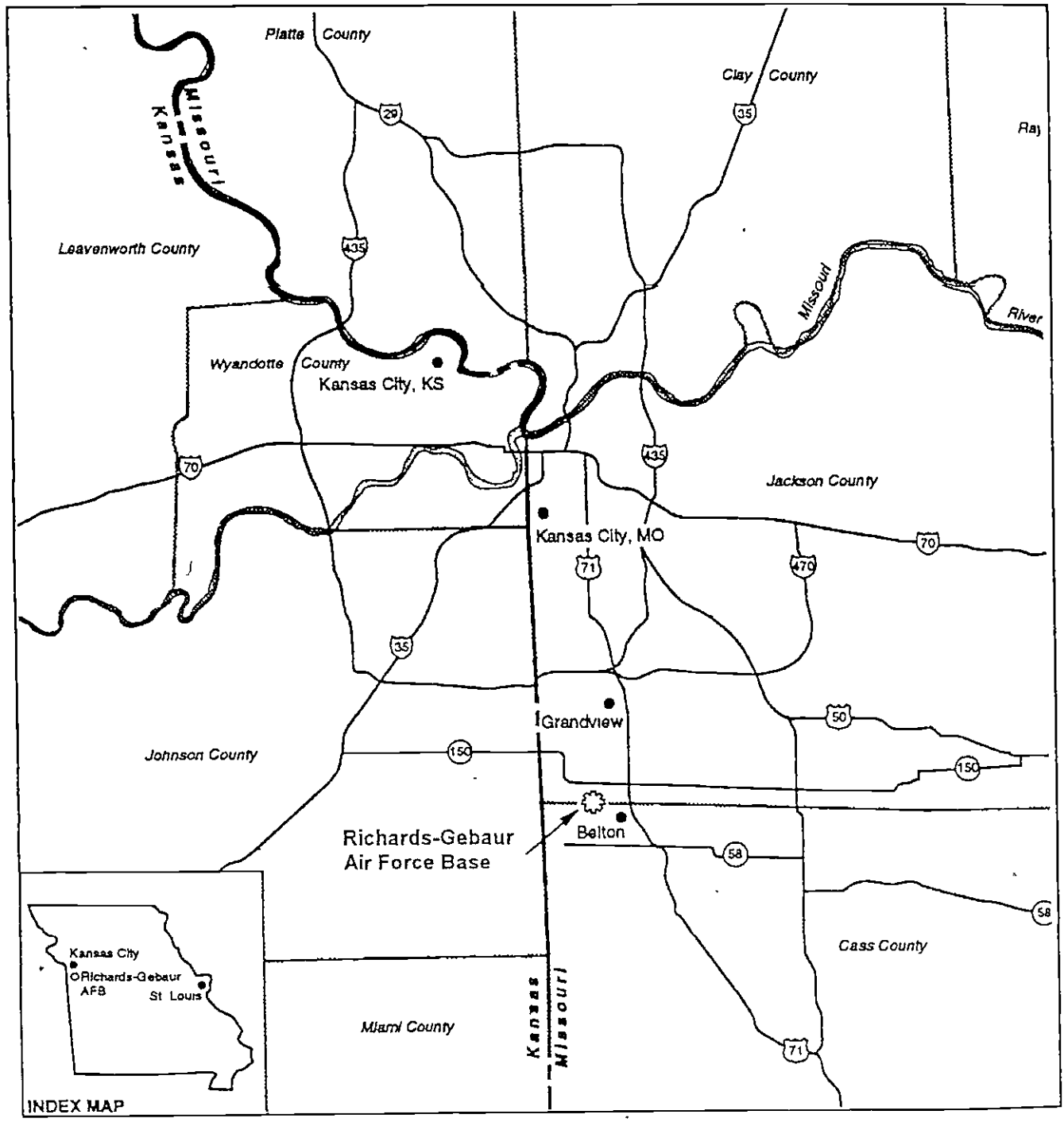


Figure 1.0-1
Richards-Gebaur Air Force Base, Missouri

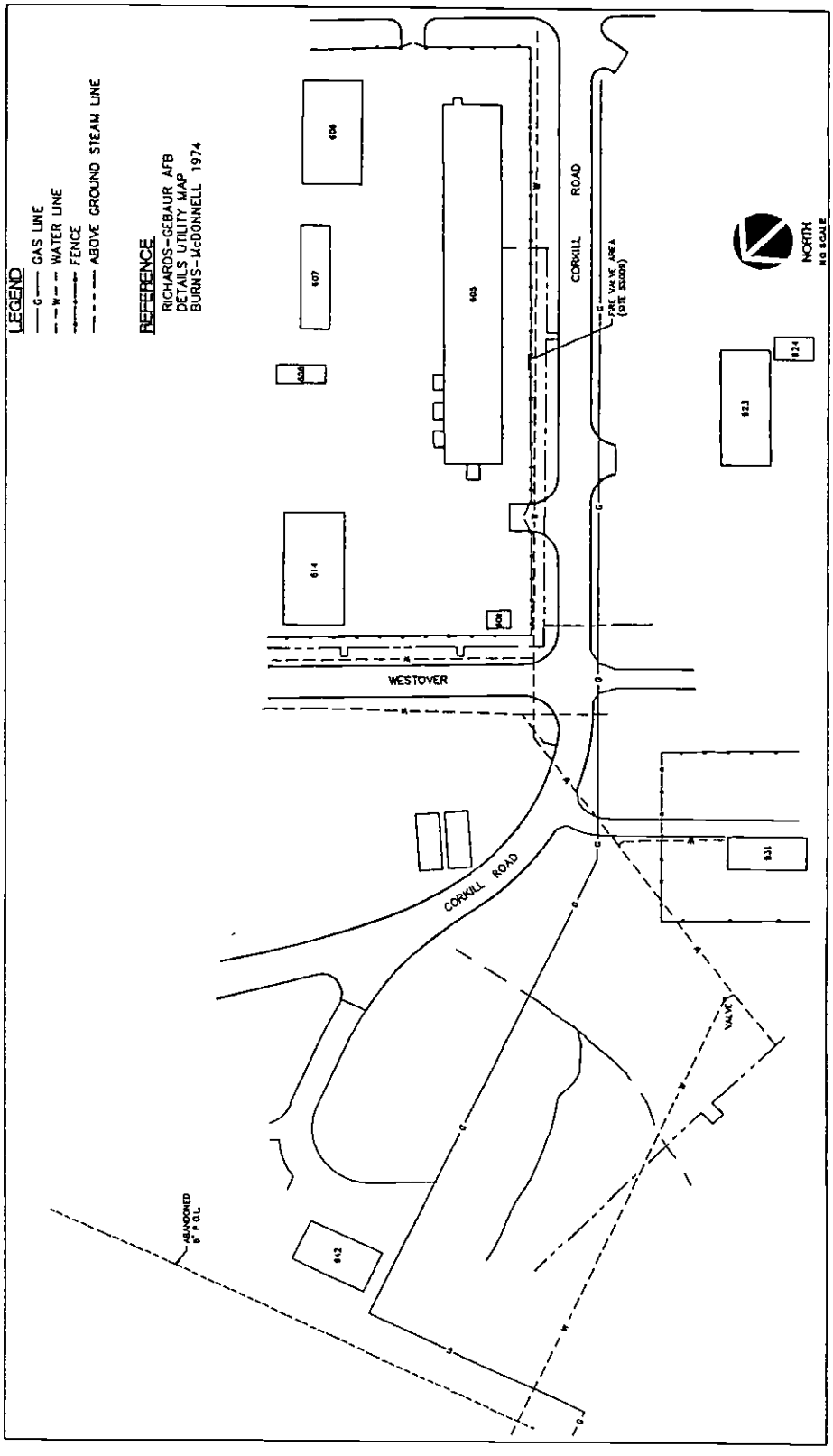


Figure 1.0-2
Location of the Fire Valve Area
Richards-Gebaur AFB, Missouri

1.1 Purpose and Scope of the PA/SI

On 08 July 1993, Tetra Tech, Inc., was tasked by the Air Force Center for Environmental Excellence (AFCEE/ESR) under Contract No. F33615-90-D-4006, Delivery Order 0008, to perform a PA/SI of the Fire Valve Area, IRP Site SS009 on Richards-Gebaur AFB. The Statement of Work for this project is provided in Appendix B. This Technical Report describes the activities conducted as part of the PA/SI for the Fire Valve Area.

The purpose of the PA/SI was to ascertain the source of the petroleum contamination detected in the Fire Valve Area, determine whether contamination remained in the Fire Valve Area, and identify potential threats to human health and the environment in relation to this site.

The scope of the field investigation included determining whether the source was localized or extended beyond the Fire Valve Area. A localized source would have been the result of a spill possibly associated with past operations at Building 605, or leaking underground storage tanks, if present in the area. If the source extended beyond the Fire Valve Area and remained in the utility trenches, then the contamination could be associated with underground pipelines containing jet fuel. Utility maps of Richards-Gebaur AFB indicate that an abandoned jet fuel pipeline appeared to intersect underground utility lines (i.e., gas, water, etc.) northwest of the site, creating a potential conduit for the jet fuel to migrate. A Hydrant Piping Study Phase I was conducted in 1993 that showed a significant leak in the jet fuel line behind Building 942 (Burns & McDonnell, December 1993).

In order to determine whether the spill was localized or extended beyond the Fire Valve Area, the field investigation required drilling soil borings and collecting soil samples in the immediate area of the site, and then directing the field sampling effort to follow the utility conduits. Soil samples were analyzed by a portable GC to assess volatile organic compound contamination. A percentage of these soil samples (Appendix E) were then submitted for laboratory analyses to determine concentrations of compounds (volatile organic compounds, semi-volatile organic compounds, and total petroleum hydrocarbons).

In addition, the potential for groundwater contamination was assessed. If it had appeared that contamination was not present, then a groundwater monitoring well was to be installed and sampled. The purpose of the well would be to confirm that the groundwater was not contaminated by this site. However, hydrocarbons were detected in the soils indicating the potential for groundwater contamination. Several monitoring wells would be necessary to properly investigate the groundwater system underlying the site, which was beyond the scope of the PA/SI; therefore, a monitoring well was not installed. Further investigations are recommended to evaluate the groundwater in the Fire Valve Area.

Potential groundwater, surface water, and direct contact pathways were investigated to determine whether there are receptors (human and ecological) within the affected area. If no permanent or transient receptors exist for a site or its affected area, no further action is appropriate. Potential receptors (present and future) that may come into contact with the contamination have been identified and are presented in Section 4.0.

1.2 Description of the U.S. Air Force IRP

The objective of the U.S. Air Force IRP is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations, and to develop remedial actions consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) for those sites posing a threat to human health and welfare or the environment. Over the years, IRP requirements have been developed so that the Department of Defense (DOD) complies with all Federal laws such as the Resource Conservation and Recovery Act (RCRA); National Contingency Plan (NCP); Federal Facilities Compliance Act; and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

1.3 Background Information

Richards-Gebaur AFB is a closed Air Force Base operated by the Air Force Base Conversion Agency, and is located in west-central Missouri, approximately 18 miles south of downtown Kansas City and 2.6 miles from the Kansas State line. The Base is bounded by the City of Belton on the east and south, and is surrounded by Kansas City to the north and west. The Base is divided by the Jackson and Cass County line, which is located through the middle of the Base, along an east-west line. Richards-Gebaur AFB is not on the National Priorities List (NPL) and has not entered into a Federal Facility Agreement (FFA).

In 1941, the land occupied by Richards-Gebaur AFB was acquired by Kansas City for use as an auxiliary airport (Grandview Airport). In 1952, the Aerospace Defense Command leased the airport from the City for air defense operations, and in 1953 the property (approximately 2,400 acres) was formally conveyed to the U.S. Government for establishment of an Air Force Base. The C-46 airlift aircraft were the original Air Force reserve aircraft stationed at the Base. Conversion to C-119 and C-124 aircraft occurred in 1957 and 1961, respectively. In 1957, the Base was named Richards-Gebaur AFB.

Until 1970, the Air Defense Command (ADC) had the primary mission on Base. In 1970, the Air Force Communications Service (AFCS) relocated its headquarters from Scott AFB, Illinois to Richards-Gebaur AFB, and assumed command. In 1971, the C-124 reciprocating engine aircraft were replaced by C-130 aircraft. This conversion reduced industrial waste quantities produced at the Base (e.g., approximately half as much waste oil was generated with the C-130s). The AFCS moved back to Scott AFB in 1977, and Richards-Gebaur AFB came under the Military Airlift Command.

The number of active duty military and civilians at Richards-Gebaur AFB was reduced from a maximum of about 5,000 personnel during the active years of the Base to less than 500 full-time personnel. By September 1979, the majority of the operating support functions were transferred to Talley Services, Inc., a civilian contractor. The Air Force Reserve (AFRES) assumed operational control in October 1980. In 1982, Base mission changes resulted in the conversion to A-10 fighter aircraft from the C-130s, causing a substantial decrease in the quantities of waste oils, fuels, and solvents generated. The AFRES 442nd Fighter Wing had the most recent primary

mission on Base, though the A-10 Thunderbolt II Aircraft Wing was transferred to Whiteman AFB in June 1994.

The majority of the Base facilities (runways and taxiways) and properties were transferred to the Government Services Administration (GSA) in 1981, and an interim lease and joint use of the airport with Kansas City became effective. The excessed parcels were subsequently transferred by GSA for public and other military uses to the cities of Kansas City and Belton, Missouri, and the Department of the Navy and the Department of the Army. Base property at the present time comprises 848.34 acres as follows: 427.77 acres in fee (including 244.12 acres of Richards-Gebaur AFB proper, and 183.65 acres for the Belton Training Annex); and 420.57 acres in easements.

1.4 Topography and Surface Drainage

The topography of Richards-Gebaur AFB is gently rolling with an average elevation of approximately 1,000 feet above mean sea level. The regional terrain is characterized by a nearly level plain that has been incised by tributaries of the Missouri River, resulting in rolling hills with relative relief ranging from 50 feet to 150 feet. The Base is situated on the south-central portion of a broad plateau known as the Blue Ridge, with the Blue River to the west and the Little Blue River to the east. The Blue River basin and the Little Blue River basin provide drainage for the area. Both rivers flow to the northeast into the Missouri River, located approximately 20 miles north of the Base. All Base drainage is located within the Little Blue River drainage basin. Within this drainage basin, Base storm water flow is generally toward Scope Creek, which flows from south to northeast through the Base, as shown on Figure 1.4-1.

1.5 Geology/Hydrogeology

Geology

Richards-Gebaur AFB is located within the Osage Plains region of the Central Lowland physiographic province. The region is characterized by low relief, wide, maturely dissected uplands, and relatively steep valley slopes. Within Jackson and Cass counties, sedimentary rocks of Pennsylvanian age (Kansas City Group) comprise the uppermost geologic units and reach a thickness of about 500 to 900 feet. In general, the rock strata dip toward the northwest at about 10 feet per mile. The regional dip may be modified locally by low anticlines, synclines, and domes. Richards-Gebaur AFB is located on the King anticline, a structural rise favorable for oil and gas production and the oldest gas producing area in Cass County; however, gas production ended in 1938 (CH2M Hill, 1983).

The geology of the Base is characterized by very thin loess deposits over residual soils derived from the in-place weathering of the underlying limestones and shales. Rock outcrops are found along Scope Creek. Exposed rocks include the Wyandotte Formation (Argentine Limestone Member), the Lane Formation, the Iola Formation (Raytown Limestone Member), and the Chanute Formation. The generalized geologic section for Richards-Gebaur AFB is shown on Table 1.5-1.

Figure 1.4-1
Topography and Surface Drainage, Richards-Gebaur Air Force Base, Missouri

Table 1.5-1
Generalized Geologic Section at Richards-Gebaur AFB

System	Group	Formation	Thickness (App. Ft)	Member (Identified for Exposed
Quaternary	Alluvium Loess	--	--	
Pennsylvanian	Douglas	Stranger	--	Tonganoxie ?
	Lansing	Stanton	20 5 8	Stoner Limestone Eudora Shale Captain Creek Limestone
		Vilas	20	
		Plattsburg	15 1 4	Spring Hill Limestone Hickory Creek Shale Merriam Limestone
	Kansas City	Bonner Springs	20-25	
		Wyandotte	35-40 ½-2 35-50 ½-3 3	Farley Limestone Island Creek Shale Argentine Limestone Quindaro Shale Frisbie Limestone
		Lane Iola	20-60 7-12 ½ 0-2	Raytown Limestone Muncie Creek Shale Paola Limestone
		Chanute Drum	15-33 2 ½-10	Cottage Grove Sandstone Corbin City ? Cement City
		Cherryville	12-45 5-22 0-25 3/4-2 ½ 3-8	Quivira (Belton Sandstone) Westerville Wea Block Fontana
		Dennis	25-35 3-5	Winterset Stark-Canville
		Galesburg Swope Ladore Hertha	1-4 30 1-4 22	
	Pleasanton		90-150	
	Marmaton		125-175	
	Cherokee		250-350	
Mississippian	Osagean		170-240	
	Chouteau		100	
Devonian			75-95	
Ordovician			500-600	
Cambrian			400-500	
Precambrian			--	

Reference. Geology of the Belton Quadrangle, Gentile, MDNR, RI 69.

The Argentine Limestone Member of the Wyandotte Formation is the predominant rock unit and caps most of the upland areas. The unit consists of a highly weathered limestone that reaches a maximum thickness of about 50 feet. Weathering has produced enlarged, clay-filled, vertical joints and layers of soft clay along horizontal bedding planes Groundwater moves through these joints and planes where conditions permit. The Lane Formation underlies the Wyandotte Formation and is described as a grey micaceous shale of generally low permeability with several feet of cross-bedded sandstone near the top of the Formation. The thickness of the Lane Formation ranges from 20 to 60 feet and outcrops on the Base range from 35 to 45 feet. The Raytown Limestone Member of the Iola Formation is a thin limestone unit about 10 feet thick that outcrops along the banks of Scope Creek. The Chanute Formation, comprised primarily of shale with interbedded limestone stringers, underlies the Raytown Limestone Member. The Chanute Formation is not exposed at the Base but is covered by alluvial soils along Scope Creek. Rock units underlying these formations consist of sedimentary rocks overlying a Precambrian basement rock of granite at depths greater than 2,500 feet (Gentile, 1984 and CH2M Hill, 1983).

The bedrock underlying the Fire Valve Area was not cored during the PA/SI; drilling advanced to bedrock/auger refusal at a depth of 14 feet below ground surface (bgs) with weathered limestone fragments recovered in the sampler at 14 feet bgs. The soil borings for the PA/SI (B1 through B4) describe a greenish-gray clay grading to a tan clay at approximately 8 to 10 feet. The tan clay from 10 to 14 feet bgs was described as having a platy weathered bedrock texture with limestone fragments at its base. Utilizing the Geologic Map (Figure 1.5-1) to determine rock units from the mapped outcrops, the Raytown Limestone Member appears to be the bedrock unit underlying the Fire Valve Area. A geologic cross section has been prepared from the soil borings drilled during the PA/SI; however, the cross section only shows the soils encountered, as bedrock was not cored. The plan location of the cross section is shown on Figure 1.5-2 and the cross section is shown on Figure 1.5-3. The soils are discussed in more detail in Section 1.6.

Hydrogeology

Regionally, Richards-Gebaur AFB is located within the Osage-Salt Plains groundwater area of the Central Nonglaciated Plains groundwater region. The Osage-Salt Plains area is characterized by Pennsylvanian and Mississippian sandstone and limestone aquifers that yield water from shallow wells at low rates; wells deeper than 400 feet yield non-potable, mineralized water. Total dissolved solids exceed 1,000 ppm in aquifers capable of yielding adequate water volumes to municipalities or industries. In southwest Jackson County and northwest Cass County, the total dissolved solids may exceed 40,000 ppm.

The shallow groundwater aquifers present in the uppermost limestone formations of Pennsylvanian age have been used in some areas of Jackson and Cass Counties for domestic use, but yields are very low (1 to 3 gpm), quantities are seasonal, and the water quality is highly mineralized (CH2M Hill, 1983). There are no water supply wells at Richards-Gebaur AFB. Recharge occurs in outcrop areas and by percolation through overlying strata where joints, fractures, or faults are present. Release of groundwater in storage from the shales is slow, limiting the usefulness of the limestones as water supply aquifers. Groundwater discharge from the shallow limestones and shales occurs in outcrop areas along the Missouri River and its tributaries, including Scope Creek.

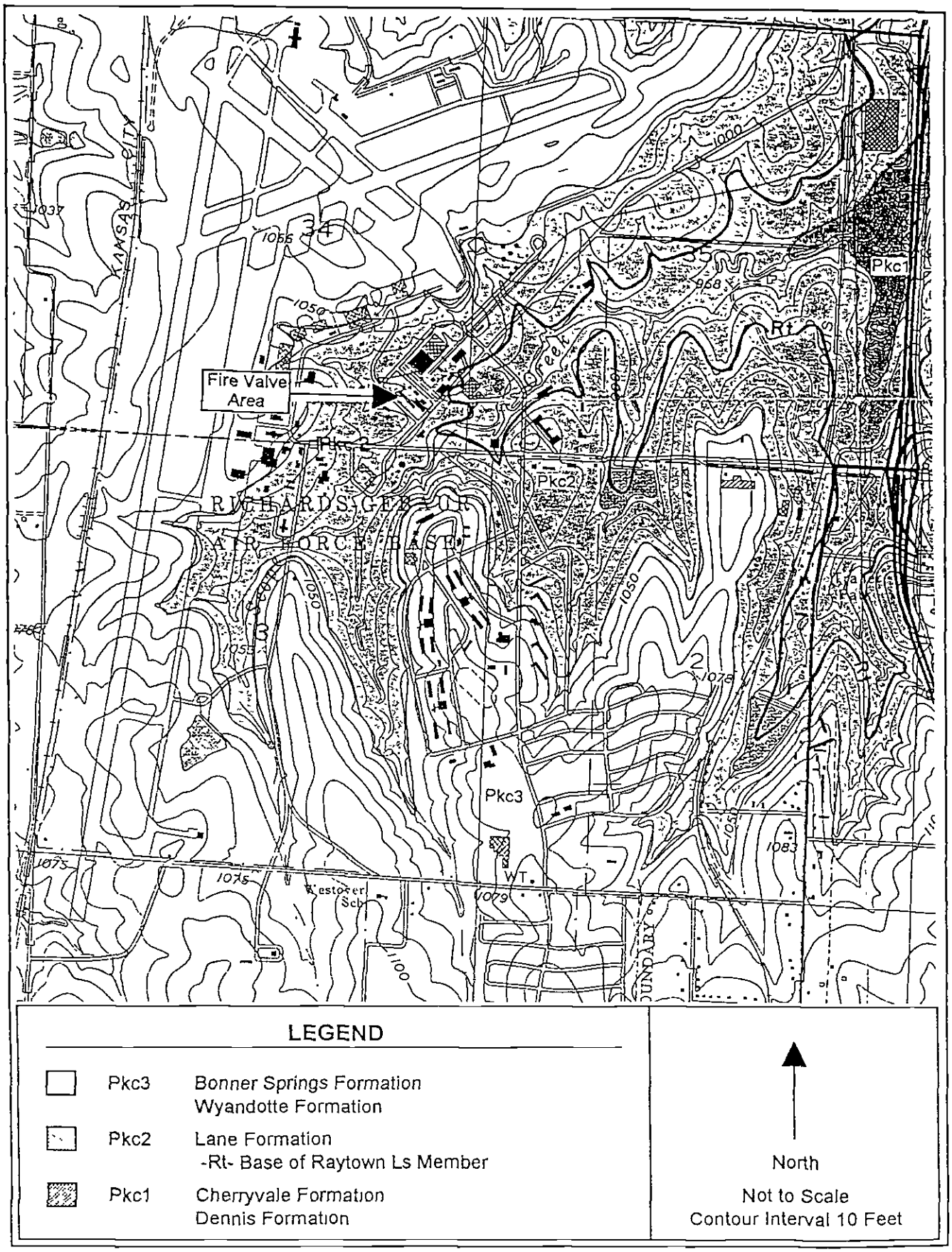


Figure 1.5-1
Geologic Map, Richards-Gebaur Air Force Base, Missouri

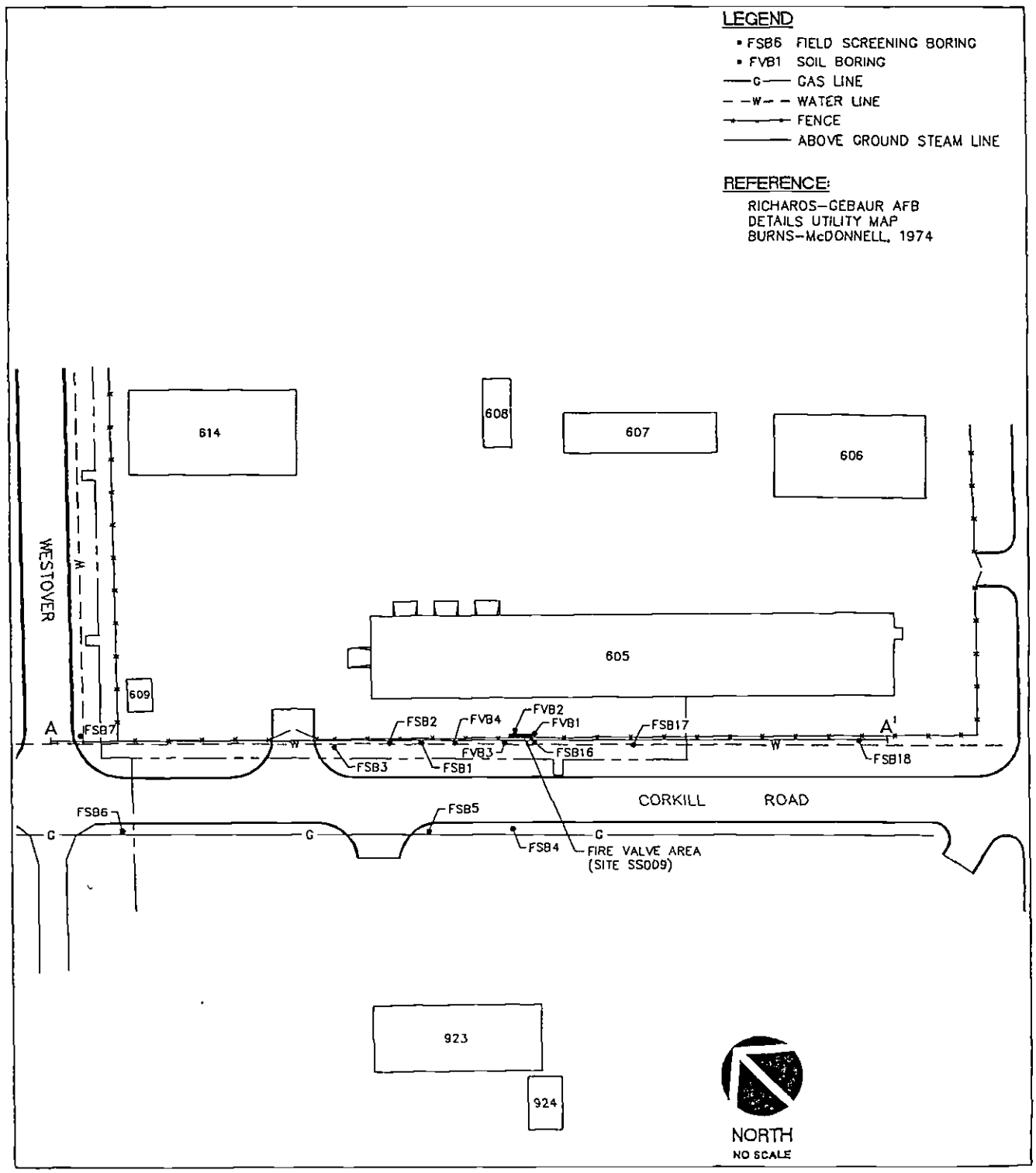


Figure 1.5-2
Cross-Section Location Map A-A'

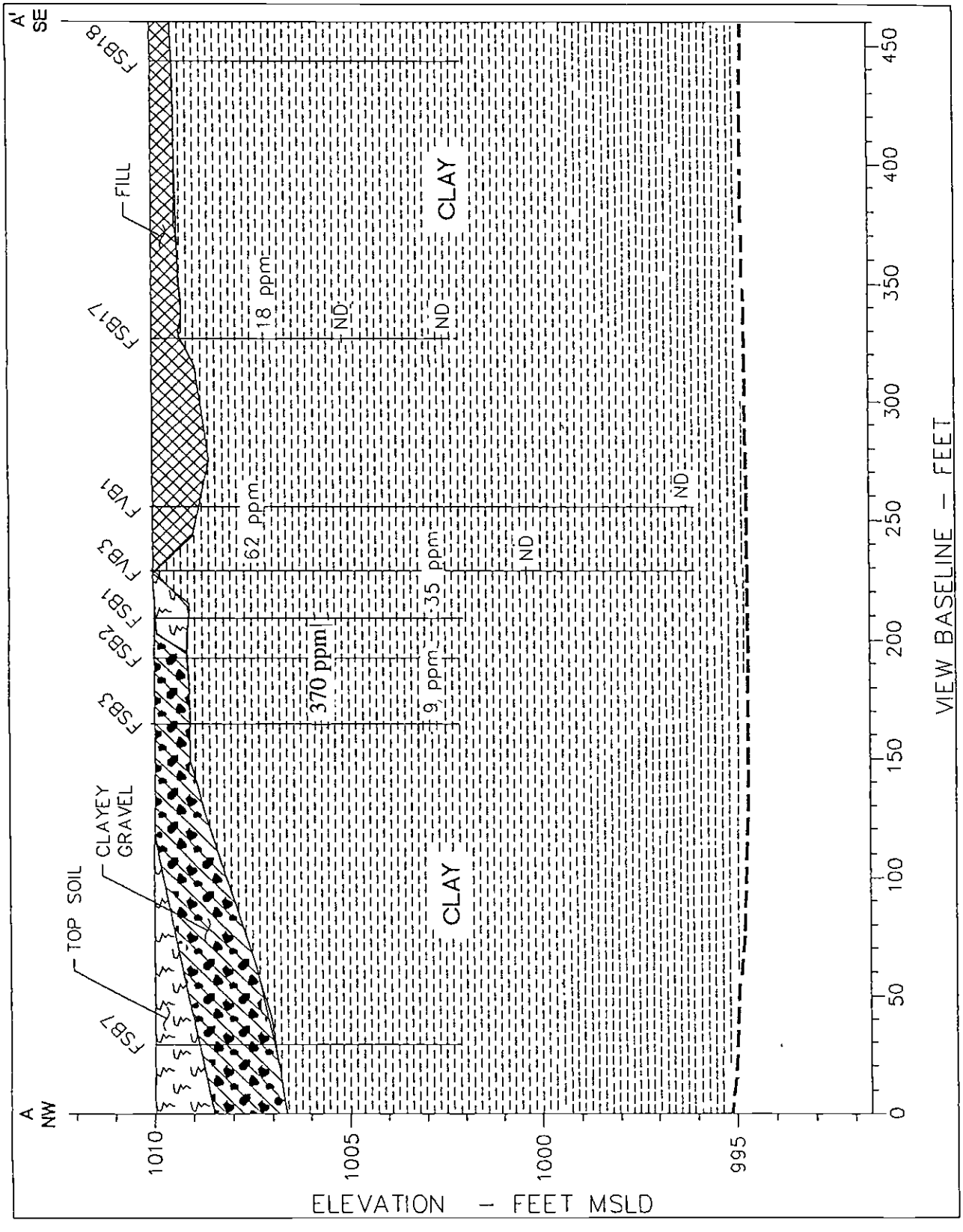


Figure 1.5-3
Geologic Cross-Section A-A'

The depth to groundwater across the Base is generally shallow (several feet to approximately 30 feet) and varies over short distances. A seasonal variation in groundwater elevation is observed (seasonal high depth to water of approximately two to four feet below ground surface), as well as a variation with the topography, with groundwater being deeper in areas of higher topography. Normally, seasonally high water table elevations are observed in the spring and fall, with low water table conditions occurring in the summer and winter Lower water table elevations are seen in the summer due to the occurrence of intermittent rainfall events and evapotranspiration; this results in little groundwater recharge. Groundwater levels will continue to decline until the fall when precipitation and groundwater recharge occurs. Groundwater was not encountered (e.g., saturated soils) during the drilling and sampling of the soil borings during the PA/SI; however, water was observed 2.6 feet below ground surface in one of the borings (FSB16) after the borehole was left open overnight, prior to grouting.

The general direction of groundwater flow across the Base in the shallow limestone and shale units is towards Scope Creek. The major discharge area available to the upper limestones and shales is Scope Creek through seeps and possibly springs along upland drainages .

1.6 Soils

According to the Soil Survey of Jackson County (SCS, 1984), the soils at the Fire Valve Area belong to the Macksburg-Urban series, which is defined as being gently sloping, poorly drained silt and silt clay loams, covered in places by urban features and is typically 2 to 15 feet thick (Figure 1.6-1). Permeability is moderate and surface runoff is medium. Organic matter content is moderate.

The soils in the immediate area of the Fire Valve Area were dark, mottled, greenish-grey to greenish-brown, dense, plastic clays overlying a mottled tan to tannish-grey, dense, plastic clay at a depth of approximately 10 feet. The base of the tan clay contained up to one-inch fragments of angular to subangular chert and limestone, with auger refusal at 14 feet. The soils to the northwest of the intersection of Corkill and Westover roads (FSB-11 through FSB-15, Appendix C) are comprised of reddish-brown to dark brown clay overlying the tan clay at a depth of approximately five feet. To the southeast of the Fire Valve Area (FSB-18, Appendix C), the tan clay was encountered just beneath the surface soil and gravel. Figure 1.5-3 shows the geologic cross section of the soils observed in the Fire Valve Area; the base of the clay is estimated.

1.7 Climate

The following climate information was also obtained from the Soil Survey of Jackson County (SCS, 1984). The consistent pattern of climate in Jackson County, MO and for Richards-Gebaur AFB is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early summer. In winter, the average temperature is 33 degrees F, and the daily minimum temperature is 24 degrees. In summer, the average temperature is 78 degrees, and the average daily maximum temperature is 88 degrees. The total annual precipitation is 35.75 inches, of which 70 percent falls in April through October. Peak precipitation occurs in the spring and fall, whereas summer rainfall events are intermittent. The average seasonal snowfall is 22 inches. The average relative

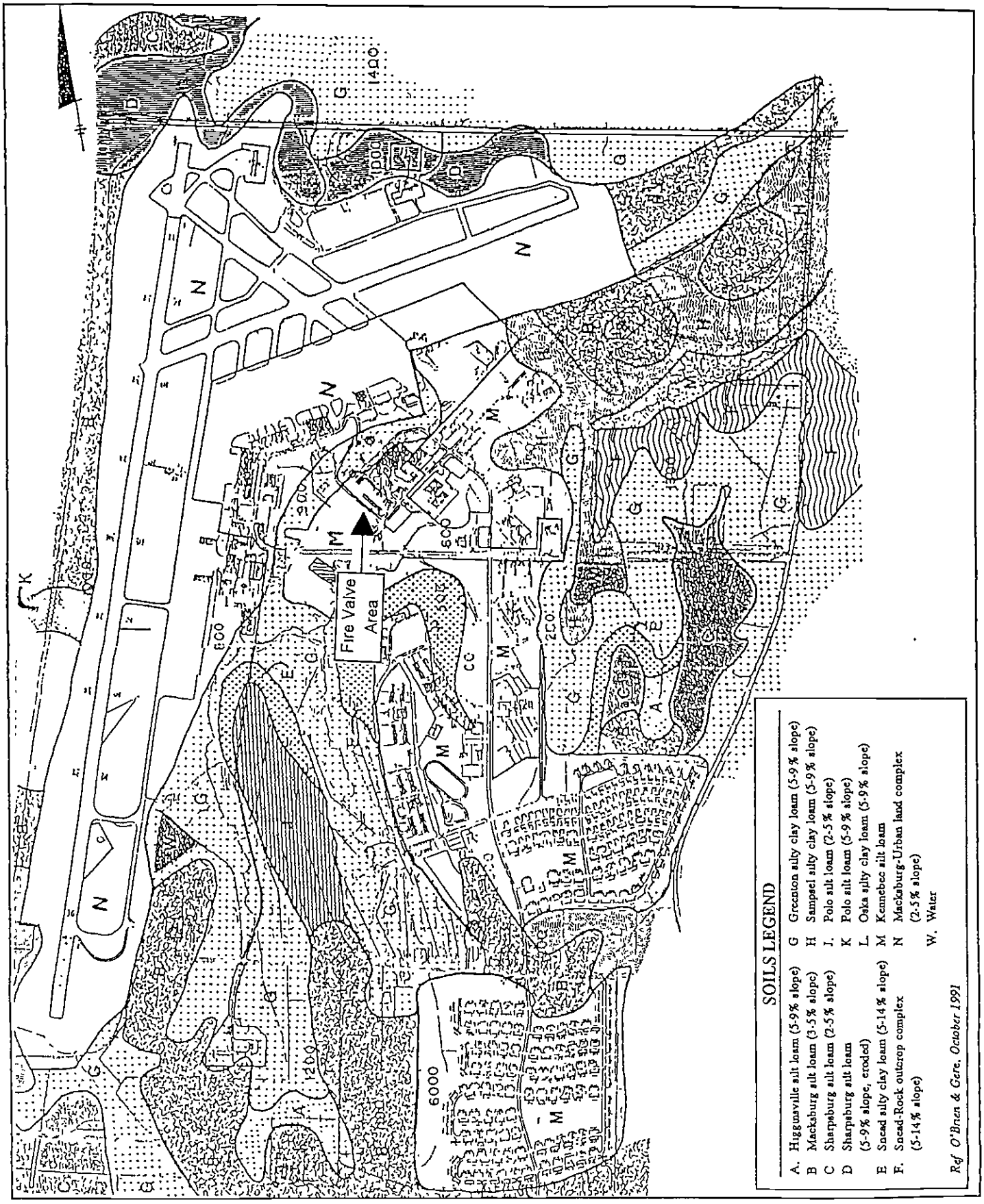


Figure 1.6-1
Soils Map, Richards-Gebaur Air Force Base, Missouri

humidity in mid-afternoon is about 60 percent; humidity is higher at night, and the average at dawn is about 80 percent. Prevailing winds are from the south.

1.8 Contaminant Sources and Contamination

As stated previously, petroleum product was discovered in the Fire Valve Area during an excavation to repair an underground water main valve. Approximately 10 cubic yards of contaminated soil were removed from the area. The depth of the excavation was approximately five feet below ground surface. The soil was tested for BTEX and TPH (Appendix M), and the results of the analyses showed contamination exceeding the State of Missouri's cleanup goals for sites requiring corrective action (listed in the Missouri Site Characterization Document, February 1991) for xylene and TPH, as shown on Table 1.8-1. The source of the petroleum product was investigated as part of this PA/SI.

Table 1.8-1
Results of March 1992 Soil Analyses from Fire Valve Area
Richards-Gebaur AFB, MO

Compound	Concentration (mg/kg)	Missouri Cleanup Level[a] (mg/kg)
Benzene	<0.01	1
Toluene	2	5
Xylene	28	10
Toluene	4	10
PAHs	24,870	200

Source: Kansas City Testing Laboratory (Appendix M)
[a]Reference: Missouri Site Characterization Guidance Document, February 1991.

2.0 PRELIMINARY ASSESSMENT/SITE INSPECTION

This section describes the tasks that were conducted according to the requirements for conducting a PA/SI in the following U.S. EPA guidance documents: Guidance for Performing Preliminary Assessments Under CERCLA (P9345.0-01A, September 1991); and Guidance for Performing Site Inspections Under CERCLA (EPA/540-R-92-021, September 1992). The field program followed the activities outlined in the Preliminary Assessment/Site Investigation Work Plan for the IRP Site SS009 (Tetra Tech, November 1993).

2.1 Field Activities

As stated previously, the objective of the field sampling effort was to collect data in order to determine the source of contamination and whether contaminated soils remained in the Fire Valve Area. The borings were placed so that the following information could be obtained: the identity of the hazardous substances present, determination of whether hazardous substances are being released to the environment, and whether hazardous substances are impacting specific targets.

Base personnel were consulted prior to the commencement of drilling activities to minimize the disruption of Base activities, to properly position borings with respect to site locations, and to avoid penetrating underground utilities. Permits were obtained from Richards-Gebaur AFB prior to drilling activities, as required.

Layne-Western was subcontracted for the drilling and sampling of soil borings. Chemical analyses of soil samples were performed by PACE, Inc. During the course of the drilling activities, a chain-link fence was taken down to facilitate access, and RPS Enterprises was contracted to re-attach the fence to the existing poles. No other subcontractors were utilized during this investigation. Tetra Tech notified the Contracting Officer's Representative (COR) and the Richards-Gebaur AFB Point of Contact (POC) regarding the fencing contractor.

2.1.1 Soil Boring Program and Chronology of Field Activities

Soil borings were drilled and sampled to further characterize the site geology/hydrogeology and determine the presence of contamination; the locations are shown on Figure 2 1.1-1. The information obtained during the drilling of the borings included determining stratigraphic units and sample depths. A phased approach was utilized in this field effort. Initially, a total of four soil borings were drilled and continuously sampled to a depth of approximately 14 feet, where auger refusal due to bedrock was encountered. These borings (FVB-1 through FVB-4) were located to the southeast, north, and northwest of the asphalt patch where contamination had previously been found at the Fire Valve Area. Due to the presence of steam lines to the southwest, a borehole was not placed in that direction; the fourth boring was placed along the water line to the northwest of the Fire Valve Area instead. These borings were drilled to determine whether contamination exists outside the previous excavation. As contamination was only observed in one of the four soil borings (FVB-3), which was located adjacent to the water line and to the northwest of the Fire Valve Area, field screening borings (a total of 18) were then drilled and sampled to determine if the source of contamination was outside the Fire Valve Area.

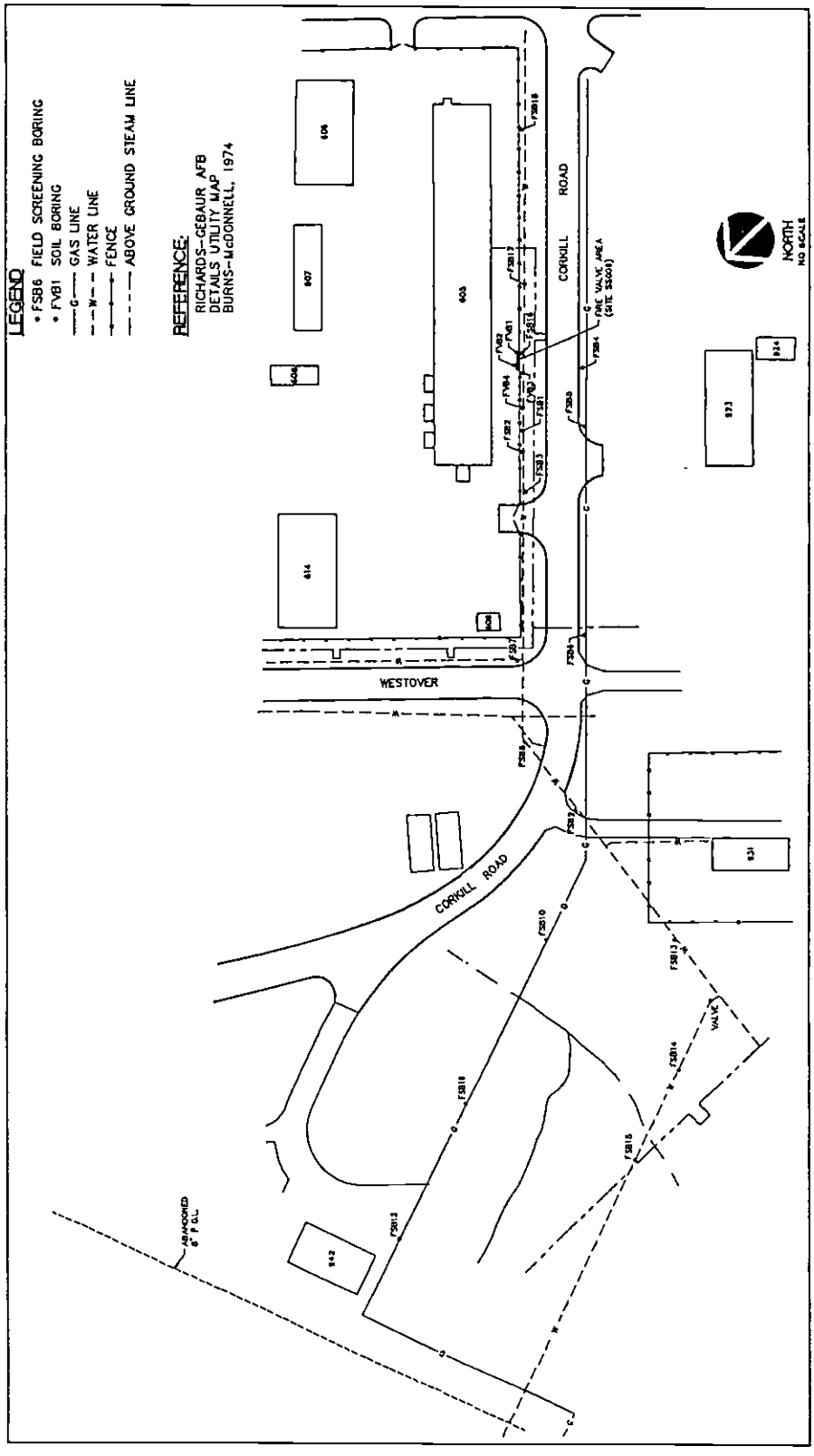


Figure 2.1.1-1
Location of Soil Borings

Drilling continued to the northwest along the gas line to Building 942, and along the water line to just north of the drainage ditch. The water line could not be investigated further due to the lack of drill rig access to the area west of the overhead steam lines. The drilling program followed those lines towards the abandoned petroleum, oil, and lubricants (POL) line located approximately 900 feet to the northwest of the Fire Valve Area. The field screening borings were placed as close as possible to the gas and water lines to try to ensure that they would be within the utility trench conduits. A magnetic locator (Schonstedt GA-52C) was used to verify the location of the utility lines that had been previously marked by Richards-Gebaur personnel. At several locations, the augers were either pushed aside (resulting in a slanted hole) by the line, or the hole had to be moved over several inches due to the line being hit. Granular backfill was not observed during the drilling of the field screening borings along these utility lines. The backfill material was a greenish-gray, soft, plastic clay observed at depths of three to five feet.

A total of 15 field screening borings were drilled along the gas and water conduits towards the POL line to determine if the line was a source; however, contamination was not detected or observed beyond the water line adjacent to Building 605. Three additional field screening borings (FSB-16 through 18) were then drilled to the southeast of the Fire Valve Area to determine the extent of the contamination observed in the water line trench (Figure 2.1.1-1). Hydrocarbon contamination was detected in one of these borings (FSB-17); however, contamination was not detected in the last boring, FSB-18, which was approximately 200 feet southeast of the Fire Valve Area and at the southeast corner of Building 605. The contamination appeared to be limited to the water line trench, mainly associated with the northern portion of Building 605, and at distances of approximately 100 feet to the northwest and 100 feet to the southeast of the Fire Valve Area. Therefore, the drilling and sampling program stopped after completing FSB-18.

Investigation derived wastes (IDW) were temporarily containerized in a covered, rolloff box located on site. Approximately three to five cubic yards of cuttings were generated. A composite soil sample (comprised of eight aliquots) was collected from the rolloff box at the completion of drilling activities and analyzed for waste characterization prior to offsite disposal. The results of the waste analyses are provided in Appendix H, as well as the manifest and associated documents indicating proper disposal of the IDW.

2.1.2 Topographic Survey Data

The locations of the soil borings and field screening boreholes were identified in the field using a compass and surveyors tape from a maximum of four appropriate landmarks. The positions of the borings have been recorded on Figure 2.1.1-1.

2.1.3 Soil Sampling and Measurement Methods

A tractor mounted drill rig was used to drill the 4 soil borings and 18 field screening borings. The four soil borings were hollow-stem augered and continuously sampled using a 3-in diameter, 5-ft long split-barrel continuous sampler. Field screening borings were augered with 4-in solid-flight augers to depths of 8 to 15 feet. Thus, the boring logs for the field screening borings are based only on auger cuttings. The samples from these borings were collected from material on the bottom of the bit when the augers were removed after reaching depths of three feet, five feet,

eight feet, etc. After completion, the boreholes were grouted with a cement/bentonite grout. The area of drilling activities was cleaned and reasonably restored to pre-investigative conditions.

2.1.3.1 Soil Screening and Sample Collection

Soils selected for screening with the portable GC and ultimately laboratory analyses were based on the judgement of the project geologist. A number of factors affected the decision to screen a particular soil stratum. Each five-foot soil core was screened using the Photo-ionization detector (PID) immediately after the continuous sampler was opened. For the field screening borings, the PID was used immediately after the auger was removed from the borehole. The PID screening guided the sampler in deciding which portion of the soil core to collect for samples. The readings obtained with the PID were recorded on the boring log (Appendix C). Other factors include the lithologic character of the soils, abnormal staining or coloration of soils, and soil structure. Several intervals within a five-ft sample core were also collected to help determine how contamination is spread vertically.

Since there was the potential that any sample collected for screening with the portable GC would be sent to the analytical laboratory, two sample containers were filled for each sample One jar was for TPH purgeables and volatile organic analyses, and another jar for TPH extractables and semi-volatile organic compound analyses.

The standard approach used to prepare soil samples for analyses with the Photovac 10S+ involved placing 20 mℓ of distilled water into a 40 mℓ vial that contained 10 grams of soil. The 10 gram sample was collected from the TPH/semi-volatile sample jar. The vial containing the soil and water was shaken vigorously to speed up the full dispersion of silts and clays in the soil. After the solution and soil sample had an opportunity to equilibrate, a sample of the atmosphere over the soil slurry was withdrawn and injected into the GC for analysis. The GC results were recorded on a log sheet and are provided in Appendix E. The chromatogram of each analysis was stored on disk. Once the samples were screened with the field GC and samples were selected for analyses by the analytical laboratory, the remaining excess samples were containerized with the cuttings from the soil borings.

2.1.4 Record Keeping

As stated previously, soil boring logs were generated for each boring drilled and contain the information as outlined in the PA/SI Work Plan (Tetra Tech, 1993). The PID readings are also provided on the boring logs (Appendix C). All the soils collected during the field sampling program were recorded in the field logbook by the sampling personnel at the time of collection The field notes also contain information specific to all field activities and are provided in Appendix D. Information concerning the Quality Assurance/Quality Control (QA/QC) for sample management is provided in Section 2.1.7.

2.1.5 Project Management

Ms. Wilhelmina I. Butcher was the Contract Officer's Representative (COR) for this work effort at Richards-Gebaur AFB through April 1995, Mr. Fred Waterman is currently the COR. Ms.

Butcher and Mr. Waterman are located at Brooks AFB in San Antonio, TX. Mr. Mark Esch is the Point of Contact (POC) at Richards-Gebaur AFB. Mr. Esch is with the Air Force Base Conversion Agency at Richards-Gebaur AFB.

The Tetra Tech, Inc. Project Manager, Mr. Russell B. Krohn, was responsible for ensuring that sample collection activities are performed in a manner to satisfactorily meet the data quality objectives of the project; for ensuring that adequate quality control provisions are incorporated into the project to ascertain that data obtained will be of known quality; and for the formal review and approval of site-specific sampling procedures and analytical requirements contained in the Work Plan and QAPP. Throughout the project, the Project Manager or Task Manager maintained contact with the COR concerning project activities.

The Tetra Tech, Inc. Task Manager, Ms. Julie WestHoff, directed site sampling activities As Task Manager, she was responsible for ensuring that site activities and sampling activities were performed according to the procedures outlined in the PA/SI Work Plan for IRP Site SS009 (Tetra Tech, November 1993). The Project Hydrogeologist, Mr. Randy Overton, provided technical support to the Task Manager during different phases of the investigation. The Health and Safety Officer, Ms. Pam McKee, was responsible for ensuring that all health and safety issues were addressed as outlined in the Tetra Tech site-specific Health and Safety Plan.

The Field Activities Team adhered to all appropriate sample acquisition, handling, analyses, and documentation procedures outlined in the Quality Assurance Project Plan (QAPP) and the Work Plan. Specifically, field personnel were responsible for the completion of all sample handling and documentation forms, including sample identification labels, chain-of-custody seals, etc. A field Quality Assurance audit was conducted on field activities and the report is provided in Appendix K. Qualifications of Tetra Tech personnel involved in this effort are provided in Appendix I.

2.1.6 Quality Assurance/Quality Control of Field Activities

Detailed information on QA/QC procedures implemented during the this investigation may be found in the QAPP located in Section C of Tetra Tech's PA/SI Work Plan for Site SS009 (November 1993). Information regarding equipment operation, calibration, and/or decontamination may also be found in the QAPP.

Field quality control samples, including trip blanks, equipment rinsate blanks, and replicates were collected or utilized during the PA/SI.

Trip Blanks

A trip blank is a set of two, 40 mℓ sample vials filled at the laboratory with Type I reagent-grade water. A trip blank was transported to the site, handled as a regular sample, and returned to the laboratory for analysis of VOCs. A trip blank was shipped with each cooler of soil or water samples for analyses of VOCs, purgeable and extractable TPH, and semi-VOCs Thus, the trip blank was shipment-specific rather than site-specific.

Equipment Rinsate Blanks
One equipment rinsate blank was collected during the drilling of soil borings at this site. The equipment blank was prepared by pouring ASTM Type I reagent-grade water through a decontaminated continuous sampler into the collection container.

Replicate Samples
A field replicate is a single soil sample that is divided into two equal parts for the purpose of analysis. One replicate soil sample was collected from this site. The replicate of the sample that was selected for analysis was given a fictitious boring number and sampling depth and sent to the laboratory for analysis.

Sample Containers and Preservation
Preservation of samples is required to retain integrity. The most common preservation techniques include pH adjustment and temperature control. Field personnel collecting environmental samples during the PA/SI used U.S. EPA-recommended containers and preservation techniques for the parameters of concern. Precleaned sample containers were provided by PACE, Inc.

Sample Identification
Each sample was identified by a unique field sample identification number indicating the site name, boring number, and depth at which the sample was collected. The sample identification for each sample was recorded on the Boring Log Form and noted in the Sample Coordinator's field logbook at the time the sample was collected. All samples were also recorded on the GC Log Form. Only those samples selected for analyses by PACE, Inc. were included on the Chain-of-Custody Records.

Data obtained from the portable GC were not made available to the analytical laboratory to prevent possible bias. Replicate samples were labeled with a fictitious boring number, sample depth, and collection time.

Sample Shipment and Custody
As samples were collected, they were immediately placed in coolers containing ice and maintained at 4° C prior to and during shipment to the laboratory. Field personnel collecting the samples were responsible for the custody of those samples until they were transferred to the GC operator, who maintained custody until those samples selected for laboratory analyses were packed and transferred to the courier. A Chain-of-Custody form was prepared only for those samples shipped to PACE, Inc. for analyses. Copies of the Chain-of-Custody forms are provided in Appendix F.

2.2 Laboratory Analyses

Laboratory analyses was conducted by PACE, Inc. of Lenexa, KS. Soil samples were analyzed for VOCs by U.S. EPA Method 5030/8240; purgeable TPH by U.S. EPA Method 5030/8015-Modified; extractable TPH by U.S. EPA Method 3510/8015-Modified; and semi-VOCs by U.S. EPA Method 3550/8270. The laboratory analytical data package is provided in Appendix G. Table 2.2-1 provides a summary of the analytical methods, and the number of soil samples and QA/QC samples analyzed during the investigation of the Fire Valve Area.

Table 2.2-1
Summary of Analytical Methods and Soil Samples Analyzed

Parameter	Analytical Method	Re port ing Unit	Number of Analyses	Trip Blanks	Equipment Blanks	Replicate Samples	Total Analyses
VOCs	SW 5030/ SW8240	mg/kg	17	4	1	1	23
Semi-VOCs	SW 3550/ SW 8270	mg/kg	17	NA	1	1	19
Purgeable TPH	SW 5030/SW 8015 Modified	mg/kg	17	NA	1	1	19
Extractable TPH	SW 3550/SW 8015Modified	mg/kg	17	NA	1	1	19
Totals			68	4	4	4	80

Note: Reporting Unit for trip blanks and equipment blanks are $\mu g/\ell$ for all analyses
NA: Not Applicable

An Analytical Data Informal Technical Information Report (ITIR) for IRP Site SS009 (Tetra Tech, 1994) has been prepared for this site and presents an evaluation and summarization of the analytical data and appropriate validation criteria. The validation criteria include holding times, method blanks, field blanks, matrix spike/matrix spike duplicates, surrogate recovery, laboratory control sample recovery, and temperature blanks. The following section (2.3-Data Evaluation) summarizes the information provided in the Analytical Data ITIR for the Fire Valve Area regarding data evaluation and validation. Tables 2.2-2 and 2.2-3 present the analytical results of the field sampling effort, and the data are qualified according to criteria described in Section 2.3

2.3 Data Evaluation

In order to assess the quality and useability of the data generated at this site, laboratory and field quality control activities were evaluated. The QC criteria included holding time adherences, method blank results, matrix spike/matrix spike duplicate recoveries, surrogate recoveries, laboratory control sample recoveries, temperature blanks, and laboratory field replicate samples.

Holding Times

The U.S. Environmental Protection Agency recommended holding times provide a means to ascertain the validity of results based on the length of time between sample collection and extraction/analyses If holding times are exceeded, the sample results may be qualified. All the data were within acceptable limits for holding times.

Method Blanks

The laboratory uses an artificial, analyte-free matrix sample to monitor the analytical batch for interferences and contamination from glassware, reagents, and other potential laboratory-generated

Table 2 2-2: Volatile Organic Results (mg/kg dry)
Soil Samples From Fire Valve Area-RGAFB

Sample ID	Acetone		Chloroform		1,2-Dichloropropane		Ethylbenzene		2-Hexanone		Methylene chloride		MIBK		1,1,2,2-Tetrachloroethane		Total Xylenes		BTEX*
FV-B1-13	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0.014)	U	**0.009**	**BJ**	(0 013)	U	(0.006)	U	(0 006)	U	ND
FV-B2-13	(0 032)	U	(0.006)	U	(0 006)	U	(0.006)	U	(0 013)	U	(0 006)	U	(0 012)	U	(0 006)	U	(0.006)	U	ND .
FV-B3-3	(0 033)	U	**0 011**		**0.007**		**0.019**		**0.029**		(0 006)	U	(0.013)	U	**0.006**	**J**	(0.006)	U	**0.019**
FV-B3-10	(0 032)	U	(0.006)	U	(0 006)	U	(0.006)	U	(0.014)	U	(0 006)	U	(0 012)	U	(0 006)	U	(0.006)	U	ND
FV-B4-3	(0.034)	U	(0 007)	U	(0 007)	U	(0 007)	U	(0.014)	U	(0 007)	U	(0 013)	U	(0.007)	U	(0 007)	U	ND
FV-B4-12.5	(0 030)	U	(0 006)	U	(0.006)	U	(0 006)	U	(0 013)	U	(0.006)	U	(0 011)	U	(0.006)	U	(0.006)	U	ND
FV-B5-3	(0 035)	U	(0 007)	U	(0 007)	U	**0.012**		**0.038**		**0.010**	**B,J**	0 014	U	(0 007)	U	(0.007)	U	**0 012**
FV-FSB1-7 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 014)	U	(0 006)	U	(0.013)	U	(0 006)	U	(0 006)	U	ND
FV-FSB3-4 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	**0.018**		**0.009**	**BJ**	**(0 013)**	U	(0 006)	U	(0 006)	U	ND
FV-FSB3-7 5	(0 033)	U	(0.006)	U	(0.006)	U	(0 006)	U	(0 014)	U	(0 006)	U	(0 013)	U	(0.006)	U	(0.006)	U	ND
FV-FSB5-4.5	(0 032)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0.014)	U	(0.006)	U	(0 012)	U	(0.006)	U	(0.006)	U	ND
FV-FSB8-2 5	(0 033)	U	(0 006)	U	(0.006)	U	**0.036**		**0.027**		(0.006)	U	(0 013)	U	(0 006)	U	**0 068**		**0.104**
FV-FSB10-4 5	(0 034)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0.014)	U	(0 006)	U	(0 013)	U	(0.006)	U	(0 006)	U	ND
FV-FSB14-7.5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0 014)	U	(0 006)	U	(0 013)	U	(0.006)	U	(0.006)	U	ND
FV-FSB17-2.5	**0.032**	**B**	(0.006)	U	(0 006)	U	(0.006)	U	ND (0 014)	U	**0.008**		(0 013)	U	(0.006)	U	(0 006)	U	ND
FV-FSB17-4 5	**0.14**	**B**	(0 007)	U	(0.007)	U	**0.01**		**0 037**		**0.013**		**0.14**		(0.007)	U	**0.045**		0.055
FV-FSB17-7.5	**0.08**	**B**	(0 006)	U	(0 006)	U	(0 006)	U	ND (0.014)	U	**0.010**		(0 013)	U	(0 006)	U	(0 006)	U	ND
FV-FSB18-4 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0.014)	U	**0.007**	**BJ**	(0 013)	U	(0.006)	U	(0.006)	U	ND

Note· Volatile organic compounds not shown were not detected above their respective Practical Quantitation Limits (PQL)
Bolded values were detected above the PQL.
* BTEX = Sum of benzene, toluene, ethylbenzene, and total xylenes
Values in parentheses are PQLs for those compounds
ND = Not detected above PQL
Data Validity Qualifiers:
B = The environmental sample result is less than five or ten times (for common laboratory contaminants) the blank acceptance level. The usability of the data could be limited since this qualifier is not based on the instrument calibration (initial and continuing calibration verification and initial and continuing calibration blank) nor internal standard data review.
J = The results are deemed qualified and usability of the data limited J is also used when the analyte results are between the Method Detection Limit (MDL) and the PQL.
U = The analyte was analyzed for, but was not detected above the MDL and was reported as Not Detected

Table 2 2-3· Total Petroleum Hydrocarbons and Semi-volatile Organic Results (mg/kg dry)
Soil Samples From Fire Valve Area-RGAFB

Sample ID	TPH (Extractable)		TPH (Purgeable)		Acenaphthene		Anthracene		2,4-Dinitrotoluene		Fluorene		2-Methylnaphthalene		N-nitroso-diphenylamine		Naphthalene		Phenanthrene	
FV-B1-13	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-B2-13	(6)	U	(6)	U	(0 3)	U	(0 3)	U	(0.3)	U	(0.3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U
FV-B3-3	62		(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	0.79		(0 4)	U	**0.31**	**J**	(0.4)	U
FV-B3-10	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0.4)	U	(0 4)	U
FV-B4-3	(6)	U	(7)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0.4)	U
FV-B4-12 5	(5)	U	(6)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0.3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 4)	U
FV-FSB1-7 5	35		(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB3-4 5	370		(6)	U	**0.20**	**J**	**0.23**	**J**	**0.34**	**J**	**0.36**	**J**	(0 4)	U	**0.61**		(0 4)	U	**0 68**	
FV-FSB3-7 5	9		(6)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB5-4 5	(6)	U	(6)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U
FV-FSB8-2 5	(6)	U	(6)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U
FV-FSB10-4 5	(6)	U	(6)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U
FV-FSB14-7 5	(6)	U	(6)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U
FV-FSB17-2 5	18		(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U
FV-FSB17-4 5	(7)	U	(7)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U
FV-FSB17-7.5	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB18-4 5	(6)	U	(6)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0.3)	U	(0.3)	U	(0 3)	U

Note. Semi-volatile organic compounds not shown were not detected above their respective Practical Quantitation Limits (PQL)

Bolded values were detected above the PQL.

ND = Not detected above PQL

Values in parantheses are PQLs for those compounds

Shaded values exceed applicable action levels

Values in parentheses are PQLs for those compounds

Data Validity Qualifiers:

J, = The results are deemed qualified and the usability of the data limited. J is also used when the analyte results are between the Method Detection Limit (MDL) and the PQL.

U = The analyte was analyzed for, but was not detected above the MDL and was reported as Not Detected

contaminants. Results of laboratory and field blank analyses are reviewed for the presence of contaminants. If contaminants are noted in the blank, the associated environmental samples may be qualified. All method blanks met QC criteria with the exception of those environmental samples that have been qualified for method blank contamination with the letter "B" in Table 2.2-3. Contaminants detected in the associated environmental samples at concentrations greater than the method detection limit but less than ten times the method blank concentration were qualified.

Field Blanks

Field blanks include trip blanks and equipment blanks as described in Section 2.1.7 of this report. The field blanks met QC criteria.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) quality control samples are used in each analytical batch at a frequency of five percent or with each different sample matrix, whichever is more frequent. The matrix spiking solutions for organics are prepared from neat materials, or from sources independent of the calibration standards. Inorganic matrix spikes are prepared for the analytes of interest at an appropriate concentration as specified in SW-846. The MS/MSD data are reviewed for consistency and compliance with specified control limits. In instances where MS/MSD results exceed control limits, laboratory control sample results and non-conformance reports are reviewed by the data validation staff to assess the possible reasons and determine whether results must be qualified. All calculated MS/MSD recoveries and relative percent difference (RPD) values either met QC criteria or were within acceptance limits, and the associated data were deemed acceptable.

Surrogate Recoveries

For gas chromatograph and gas chromatography/mass spectroscopy (GC/MS) analyses, the analytical process includes the addition, subsequent detection, and recovery calculations of surrogate spiking compounds. Surrogate compounds are added to every sample at the beginning of the sample preparation, and the surrogate recovery is used to monitor matrix effects and sample preparation. Method-specific surrogates are used in both matrix and reagent QC samples to establish the possibility of matrix interference. Calculated surrogate recoveries met QC criteria.

Laboratory Control Sample

Laboratory control samples consist of blank reagent water spiked with a known amount of analyte. The spiking analyte is from a different source than that used to establish the calibration standards. Laboratory control samples are reviewed for consistency and compliance with specified control limits. If results exceed control limits, laboratory non-conformance reports are reviewed by the data validation staff to assess the possible reasons and determine if sample results must be qualified. Calculated laboratory control sample (LCS) recoveries met QC criteria.

Temperature Blanks

A temperature blank accompanies each sample shipment cooler to monitor temperatures at which samples are received at the laboratory. Temperature blanks from coolers containing samples for volatile organic analysis (EPA Method 8240) are reviewed. If a blank exceeds control limits or no blank was included, sample results may be deemed as qualified data.

Environmental samples collected at Richards-Gebaur AFB were shipped to the laboratory the same day as collection. To maintain appropriate shipping temperatures, all samples are chilled in the field and held overnight in a refrigerator at 4°C ± 2°C. All samples are packaged and shipped according to an established protocol. Occasionally, the samples arrive at the laboratory above or below the recommended shipping temperature. Unless the temperature discrepancies are large (above 10°C or frozen samples), these minor deviations from the recommended shipping temperatures are not considered detrimental to sample quality. Temperature blanks met recommended shipping temperature criteria of 4°C ± 2°C.

Laboratory Field Replicate Samples

Replicate soil samples provide a measure of possible sampling and analysis variability. The replicate samples are prepared by cutting the soil sample in half, with one half submitted as the actual sample and the other half submitted with a fictitious sample number so that laboratory personnel are unable to distinguish the replicate from the normal field samples.

Ten percent of soil samples were replicated. The replicate soil sample for FVB3-3 was FVB5-3. The replicate sample and the RPD between the samples met QC criteria with the exception of the RPD values for total petroleum hydrocarbons and ethylbenzene, which exceeded the acceptance limits.

2.4 Sampling and Analyses Results

As previously stated, 4 soil borings were drilled and continuously sampled to a depth of 14 feet, and 18 field screening borings were augered and sampled to depths ranging from 8 to 15 feet at this site. From these borings, a total of 70 soil samples were collected for possible laboratory analyses. Based on field observations and the results of field screening by a portable GC (Appendix E), 17 of these samples were submitted for the following laboratory analyses: volatile organic compounds, semi-volatile organic compounds, and total petroleum hydrocarbons.

Detected concentrations of VOCs are provided on Table 2.2-2. Analytical results showed trace amounts (less than 0.1 ppm) of VOCs in soil samples FV-B1-13, FV-B3-3, FV-FSB3-4.5, FV-FSB8-2.5, FV-FSB17-2.5, FV-FSB17-4.5, and FV-FSB17-7.5. BTEX compounds (ethylbenzene and total xylene only) were detected in soil samples FV-B3-3 (0.019 ppm), FV-FSB8-2.5 (0.104 ppm), and FV-FSB17-4.5 (0.55 ppm).

Concentrations of semi-volatile organic compounds detected in the soil samples are provided in Table 2.2-3. Polynuclear aromatic hydrocarbons (non-carcinogenic) were detected in soil samples FV-B3-3 (total PAHs at 1.1 ppm) and FV-FSB3-4.5 (total PAHs at 0.79 ppm). In addition, FV-FSB3-4.5 showed trace amounts of 2,4-dinitrotoluene (0.34 ppm) and N-nitroso-diphenylamine (0.61 ppm).

TPH concentrations are also provided in Table 2.2-3. All the soil samples analyzed for TPH (purgeables) were not detected above the permissible quantitation limit with the exception of FV-B5-3, which is the replicate for FV-B3-3 TPH (extractables) were detected in the following soil

samples: FV-B3-3 (62 ppm), FV-FSB1-7.5 (35 ppm), FV-FSB3-4.5 (370 ppm), FV-FSB-3-7.5 (9 ppm), and FV-FSB17-2.5 (18 ppm).

2.5 Contaminants and Trend Analyses

Based on the results of the analyses discussed above, the major contaminants of concern for the Fire Valve Area are the TPH extractable compounds. The TPH extractables generally indicate fuel contamination, such as diesel or kerosene. TPH purgeables are usually indicative of gasoline components and were not detected in any of the samples analyzed; however, complete recovery of VOCs can vary with soil types, and adsorption to clayey soils may limit the extraction efficiency of the analyses.

The TPH extractables detected during this investigation were located in the water line trench, near Building 605 (Figure 2.5-1). The soil borings located to the southeast (FV-B1) and north (FV-B2) of the original Fire Valve Area excavation did not show any hydrocarbon contamination. Soil borings placed within the water line trench and north of the original excavation indicated hydrocarbon contamination (FV-B3, FSB-1, and FSB-3). The contamination does not appear to be continuous within the water line trench, as samples collected from FSB-2 and FVB-4 did not show or detect hydrocarbon contamination during field efforts or laboratory analyses. Ethylbenzene and xylene were detected at trace concentrations in FSB-8 at a depth of 2.5 feet; this boring is north of the excavation and within the water line trench. Hydrocarbon contamination was also observed and detected in FSB17, which was located south of the excavation and within the water line trench. It is possible that the contamination originated from a spill and migrated towards the southeast along the water line trench in a sinuous pattern. However, the discontinuous nature of the hydrocarbon contamination is probably related to different spill events in the past.

TPH extractables in the soil borings and field screening borings were detected in sample intervals ranging from three to five feet and seven to eight feet bgs as shown on Figure 2.5-2. Sample intervals below 10 feet, as observed in FVB3-10, did not detect TPH. The field screening borings did not extend beyond 8-ft depths in the area of Building 605, and the sample from FSB1 that was collected from the 7.5 to 8 foot depth did indicate TPH extractables at 35 ppm.

2.6 Sources

As stated previously, possible sources for the petroleum contamination were investigated. One source involved a localized spill that may have occurred in the past when the building was presumably used for motor pool operations. The other source was related to underground jet fuel pipelines that may have leaked. Utility maps of Richards-Gebaur indicate that an abandoned jet fuel pipeline appears to intersect underground utility lines (i e , gas and water), which would create a potential conduit for the jet fuel to migrate. In addition, a Hydrant Piping Study Phase I was conducted in 1993 that showed a significant leak in the abandoned jet fuel line behind Building 942 (Burns & McDonnell, December 1993). According to the BRAC Coordinator, the extent of contamination from the fuel line was limited and the contamination did not migrate to

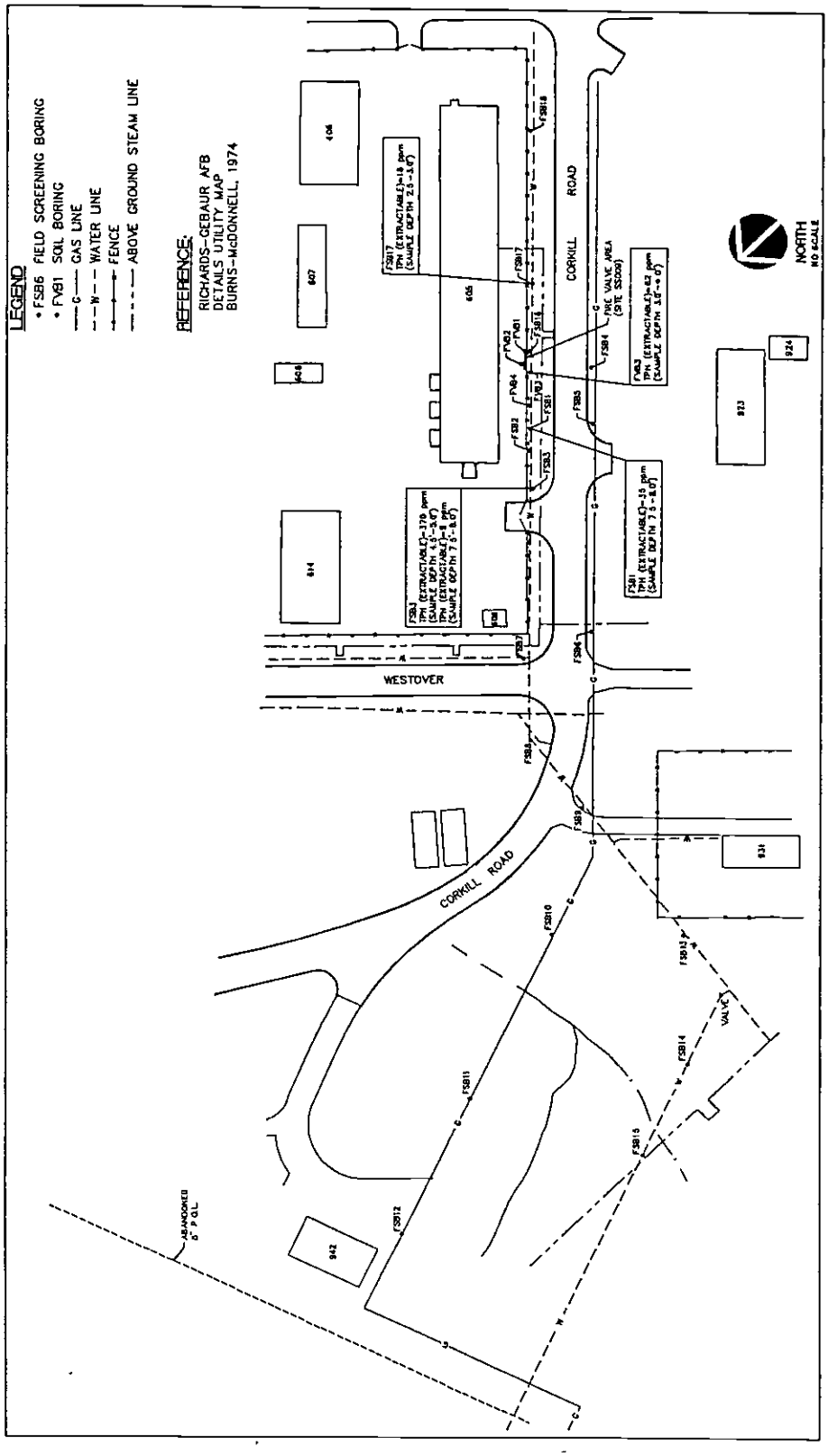


Figure 2.5-1
Concentration of TPH Extractables

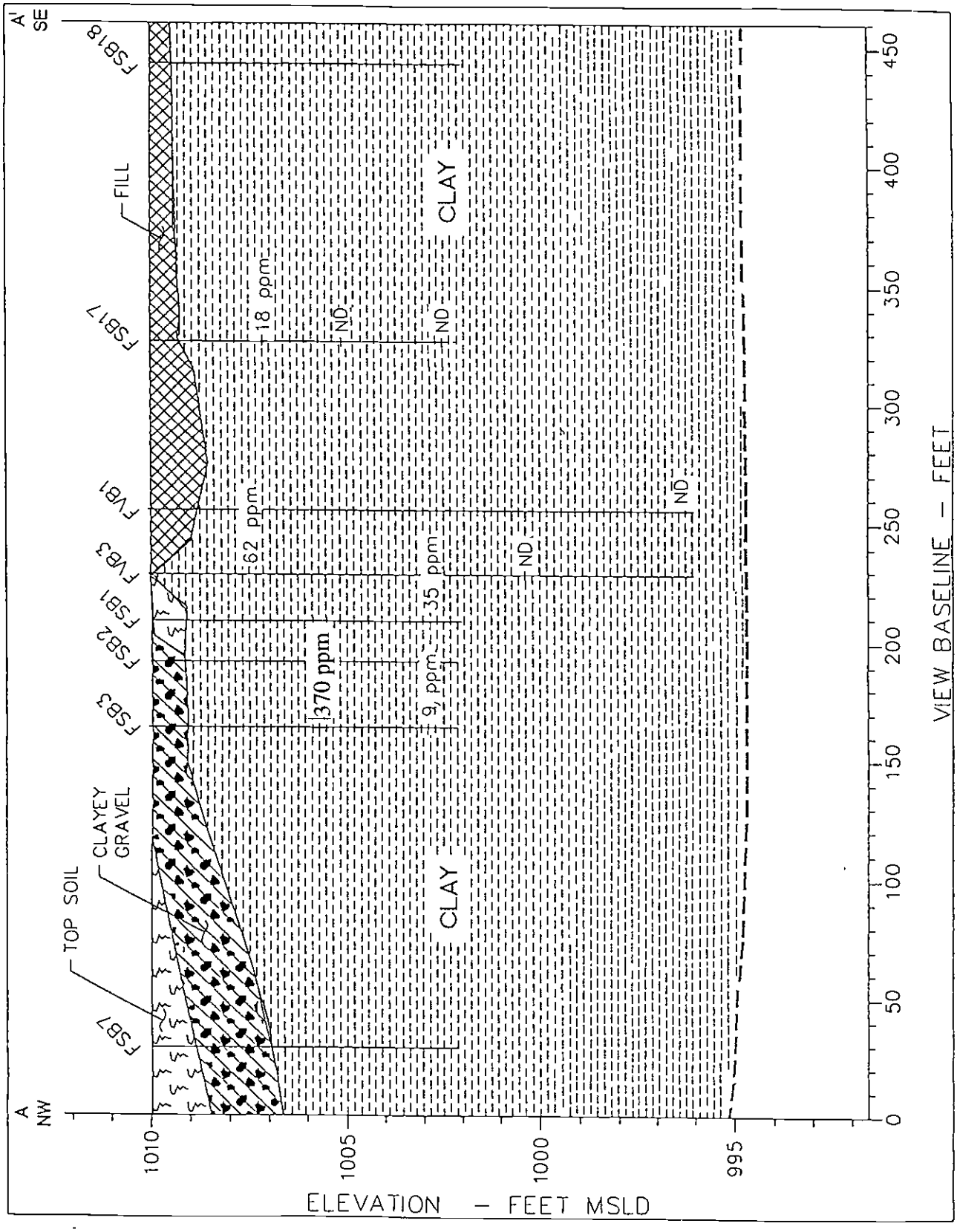


Figure 2.5-2
TPH Concentrations by Borehole Location

suspected utility lines (Esch, September 1995). The cleanup of the jet fuel behind Building 942 was completed after the PA/SI field activities were conducted. The results of the PA/SI field sampling program also showed that the abandoned POL line did not appear to be a source for the contamination observed in the Fire Valve Area. The contamination appears to be limited in extent, remaining within the water line trench and adjacent to Building 605. Therefore, the source is probably related to past operations at Building 605 or the surrounding buildings.

The source for the trace amounts of ethylbenzene and xylene detected in FSB-8 is difficult to identify but is probably not related to past operations at Building 605. The boring is located approximately 200 feet to the northwest of Building 605 and adjacent to the road.

A File Review of Base documents was conducted to find historical information on Building 605. The Record Drawings for Building 605 indicated that the building was constructed in 1953 as the A.I.O. Storage and Shop (east portion), and Road and Ground Maintenance and Paint Shop (west portion). In 1960, the I.E. Maintenance Shop addition was built on the northwest portion of the site. According to the IRP Records Search (CH2M Hill, March 1983), from 1953 to present, Building 605 has been utilized as a Carpenter Shop, Interior and Exterior Heat Shop, Paint Shop, Plumbing Shop, Refrigeration Shop, Roads and Grounds Shop, Sanitation Shop, and Sheet Metal Shop. According to Base personnel, the building was also used for Motor Pool operations; however, the file review did not specifically list this operation.

According to the Basewide Environmental Survey Richards-Gebaur AFB (U.S. Air Force, December 1993), which documents the physical condition of the Air Force Base resulting from the storage, use, and disposal of hazardous substances and petroleum products over the Base's history, Building 605 was identified as a hazardous waste accumulation point, however, the document states that hazardous waste was never stored there. The building is identified as the Base Engineering Maintenance Shop in the Basewide Environmental Survey.

Buildings, USTs, and above-ground storage tanks (ASTs) adjacent to or close to Building 605 were also researched and are shown on Figure 2.6-1. To the west of Building 605 is Facility 923, which was used to store equipment and oil drums (U.S. Air Force, December 1993). In 1988, Phase II studies identified the site (IRP Site SS004) as a hazardous waste drum storage area. Interim remedial activities have been implemented at this site due to the waste oil that was stored in this area from an unknown date until 1985. Remedial efforts included overpacking of leaking drums, removal of stained soils, and scraping of the asphalt surface. Hazardous materials are no longer stored in this area. Investigations did not indicate migration of waste oil beyond the immediate area of the facility (O'Brien and Gere, October 1991).

There is no documentation of any USTs or oil water separators within 500 feet of the Fire Valve Area (U.S. Air Force, December 1993). Four ASTs (adjacent to Building 614) were located 300 feet to the north of the Fire Valve Area (Figure 2.6-1) and have since been removed. The four tanks ranged in capacity from 44 to 90 gallons; however, the years of operation for these tanks is unknown. The tanks are reported to have contained either diesel fuel or motor gasoline. Another AST was located southwest of Building 605 and has been identified as Building 921; however, there was not a building associated with the AST. The years of operation for the AST are also unknown. This tank contained diesel fuel with a capacity of 1,000 gallons and has also been removed. The closest UST to the Fire Valve Area was located approximately 560 feet

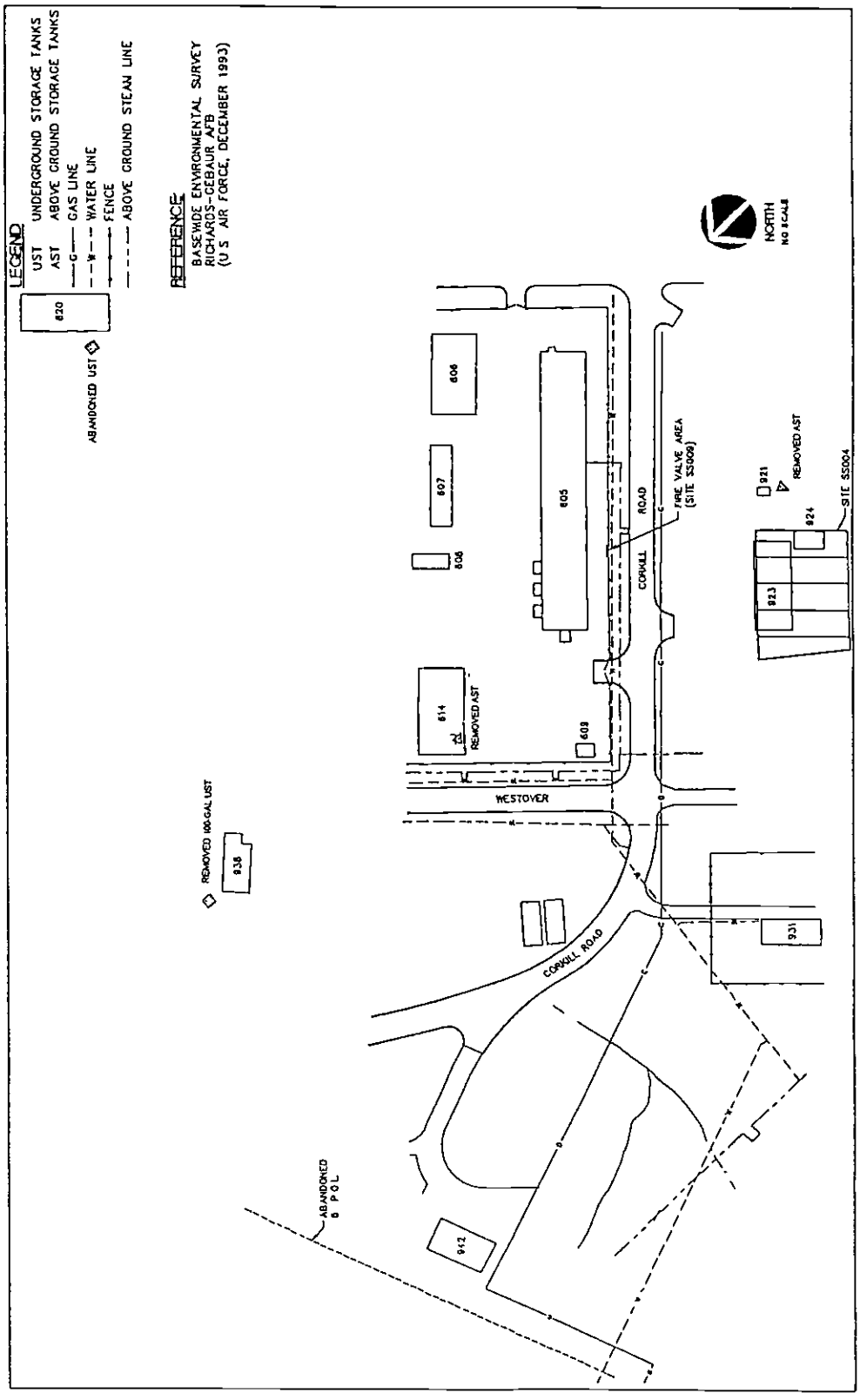


Figure 2.6-1
Locations of Potential Source Areas

northeast of the area, adjacent to Building 620; however, this tank contained waste acid and was removed in 1988. One other UST was identified approximately 675 feet to the north of the Fire Valve Area, adjacent to Building 938; this UST contained gasoline before it was removed in 1985. Therefore, based on the above literature search, the source of the hydrocarbon contamination at the Fire Valve Area is probably related to a spill or past operations at Building 605 and does not appear to be related to any surrounding USTs, ASTs, or the underground jet fuel pipeline.

3 0 MIGRATION PATHWAYS

A migration pathway is the route by which contaminants may be transported from an identified source to potential human receptors. Chemical transport may occur in the environmental medium contaminated by the initial source or in other media contaminated through intermedia chemical migration. Chemicals vary in their capacity to migrate between environmental media. Knowledge of the physical or chemical properties of contaminants aids in determining whether contaminants are likely to be transported or released from the specific media in which they are detected and also indicates the rate at which releases or transport may occur. Potential environmental migration pathways include:

- Transport of contaminants by groundwater
- Migration of contaminants
- Through the subsurface (unsaturated) soils to groundwater, with subsequent groundwater transport
- Volatilization from soils or water with subsequent transport of vapors through the atmosphere
- Entrainment of contaminated dust by the wind with subsequent transport through the atmosphere
- Runoff of chemical solutes or contaminated sediments to surface waters
- Transport of contaminants by surface water flow.

Potential migration of contaminants detected in the Fire Valve Area is discussed in this section of the report. The potential for receptor exposure to contaminants is described in terms of the properties of the detected contaminants and the four environmental media by which contaminants may migrate: groundwater, surface water, soils, and air. The U.S. EPA Potential Hazardous Waste Site Preliminary Assessment Form has been completed and provides site-specific information on migration pathways; the form is provided in Appendix L.

3.1 Identification of Exposure Pathways

An exposure pathway describes the course that a chemical takes from a source to an exposed individual. In order for an individual to be exposed to a chemical, four factors contributing to a complete exposure pathway must be identified:

- A source of chemicals of potential concern
- An impacted medium (e.g., soil)

- An exposure or contact point with the impacted medium (e.g., soil contact while working)

- An exposure route for chemical intake by a receptor (e.g., incidental soil ingestion).

The likelihood of these four factors contributing to potentially complete exposure pathways at the Fire Valve Area are examined below.

As stated above, the primary source of contaminants at the Fire Valve Area is suspected of being an undocumented spill of petroleum products that occurred at some unknown time in the past. Currently, contaminants have been detected in subsurface soils (three to eight feet deep) in a few locations. Contaminated soils in a few, highly limited locations may, therefore, be acting as secondary sources of contaminants that may impact human receptors. The following sections of the report discuss the potential for human receptors to directly contact contaminated soil or be exposed to contaminants that may migrate from the contaminated soils.

3.1.1 Soil Exposure Pathways

The PA evaluation of the soil exposure pathway considers the likelihood of exposure and targets. Targets are based on populations located on or within 200 feet of the site, and those populations within the surrounding area coming into contact with site contamination. For the Fire Valve Area, contaminated soil was observed at depths ranging from three to eight feet below ground surface. At this time, it appears that the only group of receptors likely to contact subsurface soils in this area are the utility maintenance workers. Maintenance to the water line therefore may result in contaminant exposure via:

- Incidental soil ingestion, and

- Dermal contact with soil.

These contaminant exposure pathways may, therefore, be complete. The typical Base worker is not likely to contact subsurface soils near the Fire Valve Area. Soil exposure pathways are considered incomplete for these workers.

3.1.2 Groundwater Exposure Pathways

As described above, low levels of several organic compounds have been detected in the soil in the Fire Valve Area. Groundwater contamination has not been investigated. However, there are several factors that suggest contaminants in soil may impact groundwater.

- All of the detected soil contaminants (e.g., xylenes) are relatively soluble in water, and rain infiltration/percolation through the soils could transport contaminants through the unsaturated zone to the shallow aquifer

- The groundwater underlying the Fire Valve Area is relatively shallow, varying from 3 ft to 30 bgs.

- Contamination has been found at depths similar to the upper bounds of the saturated zone; contamination may actually be within the aquifer during certain times of the year (e.g., spring and fall).

- Volatile compounds may migrate relatively rapidly in groundwater Soils in the Fire Valve Area may retard transport because of the high clay content and moderate organic content, although contaminants that reach the shallow, fractured limestones may move more rapidly.

The extent of groundwater contamination may be limited, though, because of the localized nature of the compounds detected in soils (i.e., there appears to be a relatively small mass of contaminants available for release from soils).

According to the guidance, the depth to the aquifer can be used as an indicator of the likelihood of a release to groundwater. The definition of depth to aquifer is the vertical distance between the deepest point at which hazardous substances are suspected and the top of the shallowest aquifer that supplies drinking water. Therefore, while a release to the groundwater system underlying the Fire Valve Area is possible, the depth to the shallowest aquifer supplying drinking water within a four-mile radius becomes the limiting factor.

Well search information was obtained for a four-mile radius from the Base from a previous site investigation (O'Brien and Gere, October 1991). Wells identified in the search were not active with the exception of one well, which was found to be used as a source of water for irrigation purposes. The well was located approximately two miles south of the Fire Valve Area in the northwest corner of Section 14, Township 46 North, Range 33 West. This well was reported to be a 20-ft deep, 3 to 4-ft diameter, hand dug well used for irrigation of the owners' garden. The water level was reported to be at approximately seven feet. This well is very unlikely to be affected by any possible release from the Fire Valve Area as it is located across a drainage divide located approximately 1.5 miles south of the Fire Valve Area. The groundwater south of this divide should follow surface drainage and topography and flow southward to the Osage River.

The other wells within the area were most likely abandoned due to the easy availability of superior quality water from the municipal water districts. The various municipalities in the area, as well as the Base, obtain water from Kansas City, Missouri by a series of pipelines. Kansas City obtains water from the Missouri River, which is located approximately 21 miles north of the site. Prior to conversion to municipal water, private wells drew mineralized water from Pennsylvanian shales, fractured limestones, and lenticular sandstones within the shales. Well yields were reported to range from 1 to 20 gallons per minute (gpm).

The shallow groundwater in the Fire Valve Area should generally follow the topography, and flow eastward to Scope Creek. In the Scope Creek drainage, the groundwater may follow the creek flow direction to the northeast. The regional flow direction is not known in the underlying Pennsylvanian age, Kansas City Group bedrock.

The above factors indicate that contaminants released at the Fire Valve Area could contribute to a complete (potentially limited) exposure pathway, if the groundwater is used as a drinking water

source. In other words, contaminated groundwater can only pose a potential health hazard if it is used for potable purposes such as ingestion (drinking water). Receptors must be exposed to any contaminants in the groundwater in order for there to be a complete exposure pathway and for there to be risks associated with groundwater contamination.

Under current conditions, groundwater is not used on the Base. Instead, the Base currently receives drinking water from Kansas City by several pipelines Kansas City, in turn, obtains water from the Missouri River. Since this PA/SI found only one shallow well (used for irrigation purposes) within three miles of the Base, it does not seem likely that there are any complete exposure pathways associated with groundwater, even if it has been impacted by site contaminants.

3.1.3 Air Exposure Pathways

Chemicals in soil can migrate to the atmosphere through volatilization or suspension of soil particles. Chemicals that may be involved in both of these processes have been detected in soil and soil gas samples at the Fire Valve Area. The presence of a receptor who might inhale the resulting airborne compounds would complete the soil-to-air-to-human exposure pathway.

Chemicals that sorb to soil particles can be released into the atmosphere through wind entrainment or by mechanical disturbance. Of the contaminants detected at the Fire Valve Area, the PAHs tend to sorb to soils and could potentially be released into the atmosphere. Wind, however, does not represent a method of contaminant transport at the Fire Valve Area because PAHs have been detected at depths greater than two feet bgs and would not be exposed to wind erosion. On the other hand, utility line maintenance workers may cause the release of dusts during excavation or other soil handling activities Inhalation of airborne dusts may therefore represent another complete exposure pathway for these workers. It should be noted, though, that PAHs were detected in only one soil boring and may represent a minor source of contaminants potentially released at the site.

At least two volatile compounds typically associated with fuels were detected in soils at the Fire Valve Area: ethylbenzene and xylenes. Volatile compounds may be emitted from soils as airborne vapors. Considering that the volatile compounds were found at relatively low levels and any vapors released at the soil surface will probably be rapidly diluted in the atmosphere, it appears that vapor releases may represent a potentially complete, but inconsequential exposure pathway. Once again, though, the utility line maintenance worker may be exposed to somewhat higher vapor levels because of subsurface excavation activities. The relatively low levels of volatile compounds detected in subsurface soils suggest that this exposure pathway may be minor or essentially incomplete.

3.1.4 Surface Water Exposure Pathways

Whenever chemicals of potential concern are detected in site soils, the potential exists for surface water to be impacted by surface runoff. Surface drainage from the Fire Valve Area flows from the asphalt southwestward to a grassy, drainage swale running along the northeast side of Corkill Road During rainfall events, runoff from the swale flows into the 18-inch, corrugated metal

storm sewer and to Scope Creek approximately 700 feet southeast of the site. Scope Creek is an intermittent stream that flows to the northeast and becomes perennial in the northeast part of the Base. Scope Creek merges with several other intermittent streams to form the headwaters of the Little Blue River approximately two miles from the site. Drainage patterns on the Base consist of a combination of open channels and closed drainage systems. The closed systems include pipes ranging in diameter from 18 inches to 66 inches. All Base stormwater drains into Scope Creek.

The Little Blue River is also intermittent until it merges with Oil Creek approximately 2.5 miles downstream from the site. The Little Blue River has been dammed approximately seven miles from the site to form Longview Lake. From its headwaters in Section 36, Township 47 North, Range 33 West to Longview Lake, the Little Blue River is a Missouri Class C stream and is designated for use as livestock and wildlife watering, and for protection of warm water aquatic life and human health from fish consumption. A Class C stream is one which "may cease flow in dry periods but maintains permanent pools which support aquatic life" (Rules of Department of Natural Resources, Division 20 - Clean Water Commission, Chapter 7 - Water Quality, March 4, 1991). The Little Blue River, which flows northward and eventually discharges to the Missouri River, is not listed as either an Outstanding State Resource Water or an Outstanding National Resource Water; it is listed as a Metropolitan No Discharge Stream.

There are several reasons why surface water is not likely to contribute to a complete exposure pathway:

- Runoff that exits the Fire Valve Area is transported by a storm sewer to Scope Creek, 700 ft from the area; however, surface soils were not contaminated thereby eliminating the potential for contamination via runoff
- Intermittent streams such as Scope Creek are not considered to be surface water in areas with greater than 20 inches of annual rainfall
- The nearest water bodies are Longview Lake and a small pond, respectively, seven miles and one-half mile from the Fire Valve Area.

On the basis of these factors, surface water exposure was considered to be incomplete for the Fire Valve Area and no further evaluations of this exposure pathway were conducted.

4.0 RISK EVALUATION

Potential risks associated with the Fire Valve Area are evaluated in this section. Potential Applicable or Relevant and Appropriate Requirements (ARARs) are discussed in this section also. A qualitative risk evaluation was conducted to provide a determination whether contaminants detected at the Fire Valve Area pose risks to public health and the environment. Potentially complete current and future exposure pathways have been identified based on the current understanding of site conditions.

4.1 Conceptual Site Model

A conceptual site model has been prepared that identifies current and future potential contaminant migration routes and exposure pathways (Figures 4.1-1 and 4.1-2) for the Fire Valve Area based on the site information obtained during this PA/SI. The contaminants identified during the investigation include TPH, xylenes, ethylbenzene, and PAH compounds. The maximum concentration of these compounds are shown on Table 4.1-1, which indicates TPH concentrations in soil reached 370 ppm while only trace amounts of total xylenes, ethylbenzene, and PAHs were detected in soil. Groundwater and air were not sampled.

The source of contamination is not known but is thought to be related to a past spill southwest of Building 605. Currently, there are no identifiable, potentially active sources of chemical releases in the area. However, contaminants in soil may represent a secondary, but apparently localized, source of contamination.

Potential contaminant migration pathways were evaluated in the previous section for four environmental media: soil, air, groundwater, and surface water. The potentially complete and incomplete exposure pathways associated with these environmental media are briefly reiterated below.

Soil contamination in the Fire Valve Area occurs only in the subsurface, greater than three feet deep. The typical onsite worker is not likely to contact these soils and be exposed to contaminants. That potential exposure pathway is incomplete. However, utility workers conducting maintenance along the water line could potentially contact subsurface soils and be exposed to contaminants. Exposures could occur as a result of incidental soil ingestion, dermal contact with soils, and inhalation of airborne dusts. Furthermore, volatile contaminants may be emitted from subsurface soils resulting in the exposure of utility workers to airborne vapors. These exposures are likely to be infrequent and of short duration. The underlying groundwater system at Richards-Gebaur AFB requires further investigation to determine whether the groundwater has been contaminated by releases in the Fire Valve Area. However, since the water table aquifer is not a source of drinking water, a complete exposure pathway does not exist at the current time.

Surface water in Scope Creek may not be impacted by overland flows originating from the Fire Valve Area. Also, since the stream is intermittent, any contaminated groundwater discharges to the creek are probably inconsequential. Thus, it does not appear that contaminants may reach a surface water body and there are no complete exposure pathways associated with this environmental medium.

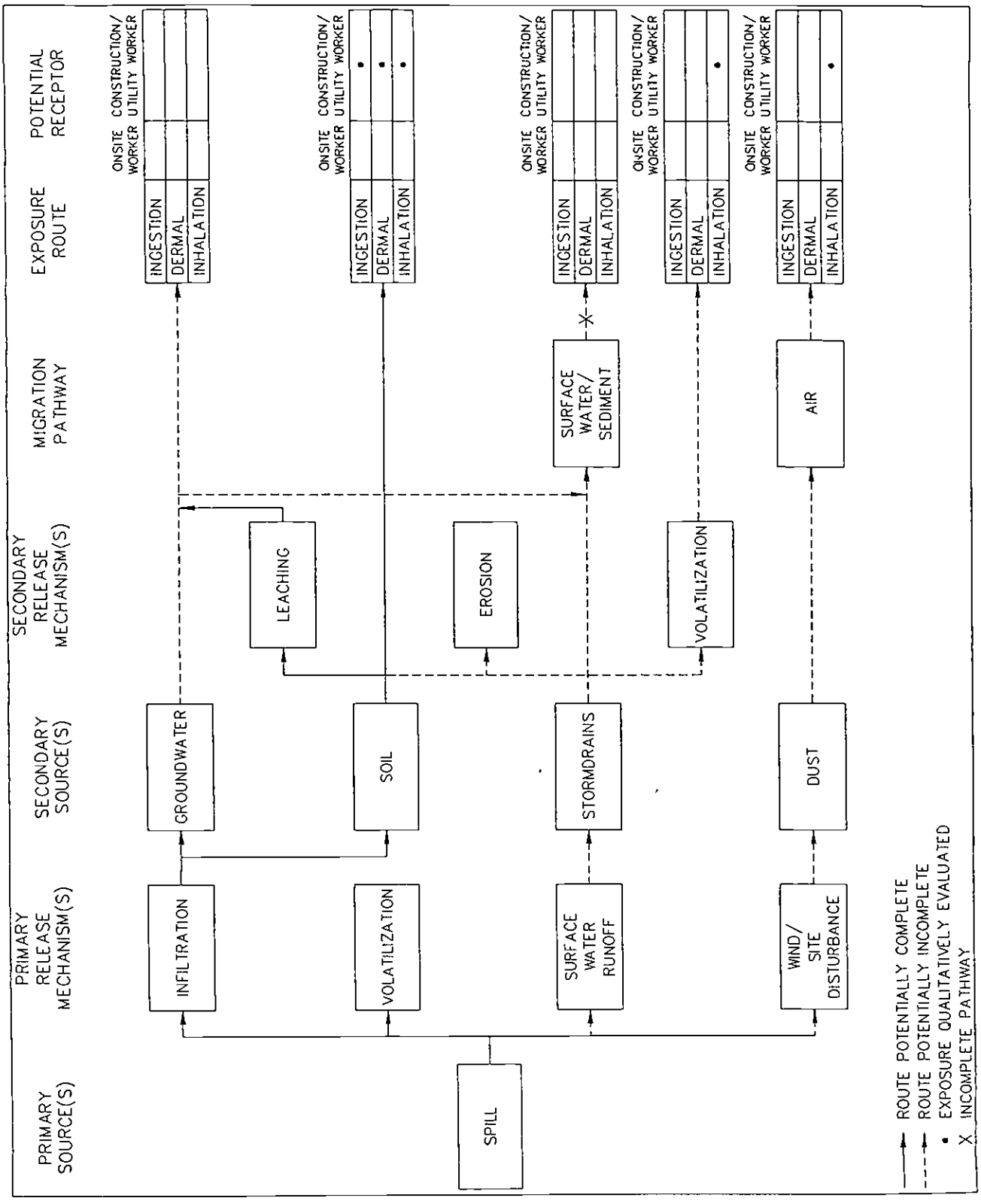


Figure 4.1-1
Conceptual Site Model of Potential Current Exposures

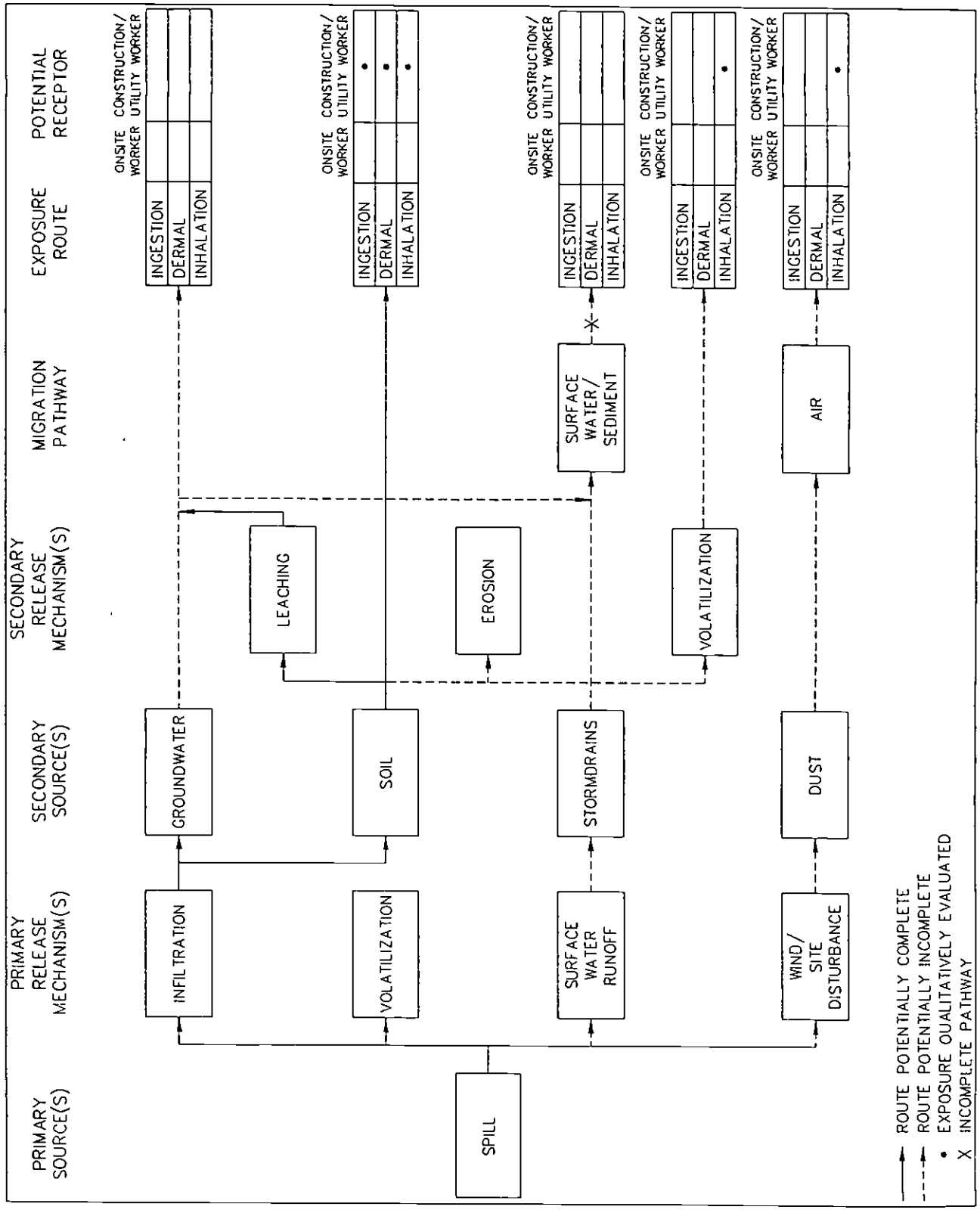


Figure 4.1-2
Conceptual Site Model of Potential Future Exposures

Table 4.1-1: Conceptual Site Model
Fire Valve Area, Site SS009, Richards-Gebaur AFB, Missouri

Site Desription	Soil Contaminants		Migration Pathway	Exposure Path/ Exposed Population	Preliminary Risk Evaluation
	Contaminant	Concentration			
Fire ValveArea Located on the south side of Bldg. 605. During excavation to repair an underground water main valve, petroleum product was discovered in trench. Contaminated soil was removed. However, additional soil contamination was identified within the water-line trench during the PA/SI	TPH Total Xylenes Ethylbenzene PAHs	370 mg/kg 0.068 mg/kg 0.036 mg/kg 1.1 mg/kg	Leaching of contaminants from soil to groundwater; contaminated soil is possible source.	Potential ingestion of contaminated drinking water; groundwater on site is not currently used for any purpose; pathway incomplete.	Groundwater Pathway incomplete as groundwater is not a source of drinking water; however, groundwater contamination needs to be determined. May exceed ARARs.
			Contaminants spread by surface water runoff.	Potential incidental ingestion, dermal contact, and inhalation; pathway incomplete.	Surface Water Pathway incomplete; surface water not impacted by site.
			Soil; contaminated Soil becomes a source.	Exposure to contaminated soil by utility workers via incidental ingestion, dermal contact, and inhalation.	Soil Pathway complete if maintenance conducted on water line.
			Air: contamination volatilizes or suspension of soil particles.	Exsposure to dust or volatiles by utility workers via inhalation.	Air Pathway incomplete; ion concentrations of volatiles easily vaporized in atmosphere.

* Maximum concentrations detected during PA/SI (March 1994).

4.2 Identification of Applicable or Relevant and Appropriate Requirements

The CERCLA Compliance with Other Laws Manual describes how Federal and State laws are identified and applied to remedial actions at hazardous waste sites. ARARs are identified by first determining whether the requirement is applicable and, if not, then whether the requirement is both relevant and appropriate. The guidance defines applicable requirements as "cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstances at a CERCLA site".

Relevant and appropriate requirements are defined as "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site".

The determination that a requirement is relevant and appropriate involves a comparison of a number of site-specific factors, including the characteristics of the remedial action, the hazardous substances present at the site, or the physical circumstances of the site. In some cases, a requirement may be relevant, but not appropriate, given site-specific circumstances; such a requirement would not be an ARAR for the site. Only portions of requirements may be relevant and appropriate for a remedial action; however, any requirement that is determined to be relevant and appropriate must be complied with to the same extent as if it were applicable.

There are three types of ARARs: chemical-specific, location-specific, and action-specific. The potential ARARs identified for the Fire Valve Area are described in the following sections

4.2.1 Chemical-Specific ARARS

The chemical-specific ARARs set levels that are considered protective of human health and the environment for the chemicals of concern in the site media, or indicate acceptable levels of discharge for those chemicals, if discharge occurs as part of a remedial activity. If there is more than one requirement that is an ARAR for a chemical, then the remedial activity must meet the more stringent requirement.

The media of potential concern identified at this time for the Fire Valve Area are the soil, and potentially the groundwater. The potential contaminant of concern for the soil and groundwater identified to date is petroleum; specifically, TPH. At present, no Federal chemical-specific ARARs for soils and sediments have been promulgated. Table 4.2.1-1 provides Federal drinking water standards that are potential ARARs for the site's groundwater; however, the groundwater system was not investigated during the PA/SI.

Table 4.2.1-1
Groundwater Standards and Guidelines

Chemical	U.S. EPA Drinking Water Standards MCL [a] (mg/ℓ)	Missouri [b] Non-Potable Groundwater Cleanup Level (mg/ℓ)
Benzene	0.005	0.05
Toluene	1	0.15
Ethylbenzene	0.7	0 32
Xylenes	10	0.32
Total Petroleum Hydrocarbons	NA	10

(a) Maximum Contaminant Level
(b) Underground Storage Tank Closure Guidance Document (MDNR, 1992)

RCRA

The Solid Waste Disposal Act (SWDA) was amended by the RCRA and the Hazardous and Solid Waste Amendments of 1984. These acts, and the regulations promulgated to enforce them establish a comprehensive program, known as the RCRA program, to control the generation, transport, and disposal of solid and hazardous waste. Because RCRA regulates all types of hazardous waste activities and is generally the most stringent Federal regulation for any activity, its conditions may be ARARs.

According to 40 CFR 261.4(b)(10), petroleum contaminated media and debris that fail only the toxicity characteristic (TC) and are subject to the corrective action requirements under 40 CFR 280, underground storage tanks are excluded from the definition of hazardous wastes. The source of the contamination does not appear to be from a leaking UST as there is no record of an UST within 500 feet of the Fire Valve Area; therefore, the contaminated soil (and potentially the groundwater) are probably not regulated under 40 CFR 280.

Because the source of the contamination is unknown but appears to be related to a past spill or release, and the contaminated soil (and potentially groundwater) are not actively managed at this time, the media are not currently regulated under RCRA. However, in the event that the contamination requires removal or remediation, then the requirements of Subtitle C regarding the identification of the waste as hazardous and the potential treatment and disposal of that waste become applicable.

Superfund

Section 104 of Superfund authorizes the Federal government to respond to a release or threatened release of hazardous substances, pollutants, or contaminants. The definitions of hazardous substances and pollutants or contaminants specifically exclude petroleum, including crude oil and hazardous components such as benzene, that are indigenous in those petroleum substances.

Therefore, the petroleum wastes at the Fire Valve Area are probably not regulated under Superfund.

State of Missouri

Missouri regulations that are more stringent than or supplement Federal standards are also potential ARARs. The State has defined a release as any loss of product to the environment. Spills from UST systems must be reported if they exceed 25 gallons; however, the contaminated soils in the Fire Valve Area do not appear to be a spill from an UST. Releases of petroleum from other sources (e.g., above-ground tanks) must be reported if they exceed 50 gallons; the volume of the spill associated with the Fire Valve Area is unknown as well as the source. The State of Missouri also provides action levels to indicate a release (TPH >25 ppm or BTEX >1.0 ppm or benzene >0.5 ppm); however, these values are not cleanup levels. Because the TPH concentrations detected in the soils exceed the action levels, then there is evidence of a release. The State has generated a matrix for determining soil cleanup levels at UST sites requiring corrective action. The matrix is provided in Appendix J, and the Fire Valve Area's total score is 80. Based on that score, the cleanup levels for the Fire Valve Area are 200 ppm for TPH compounds, and for BTEX compounds the levels are 1 ppm, 5 ppm, 10 ppm, and 10 ppm, respectively. Only one soil sample exceeded the cleanup levels for TPH with a concentration of 370 ppm; none of the soil samples exceeded the BTEX levels.

Missouri has also proposed Any-Use Soil Levels (ASLs) for residential settings that provide maximum concentrations of hazardous chemicals in soils which are acceptable to human health. For the PAHs detected, anthracene and fluorene, the associated ASLs are 17,000 ppm and 2,300 ppm, respectively. None of the soil samples collected exceeded the ASLs for PAHs, and only non-carcinogenic PAHs were detected. The ASLs for BTEX compounds were not exceeded; ASLs have not been established for TPH compounds. Table 4.2.1-2 provides the soil cleanup levels for the State of Missouri and the maximum concentration of the contaminants detected during the PA/SI.

Table 4.2.1-2
State of Missouri Soil Cleanup Guidelines for LUST Sites and Proposed Any-Use Levels

Compound	Maximum Concentration Detected (ppm)	Soil Cleanup Guidelines for LUST Sites[a] (ppm)	Proposed Any-Use Soil Levels[b] (ppm)
BTEX	ND/ND/ 0.036/0.068	1/5/10/10	170/11,000/ 5600/110,000
TPH	370	200	NA
PAH - Anthracene PAH - Fluorene	0 23 0 36	NA NA	17,000 2,300

[a] MDNR, 1992, Underground Storage Tank Closure Guidance Document.
[b] Missouri Register, 1992, Proposed Rule, 19 CSR 20-9 020 Any-Use Soil Levels for Residential Settings
ND: Not Detected
NA: Not Available

Non-Potable Groundwater Cleanup Guidelines have also been established for BTEX and TPH that may also be relevant and appropriate to the site. These values are presented on Table 4.2.1-1. The State of Missouri has established these groundwater cleanup levels for UST sites that have impacted groundwater through a release. If the groundwater is being used for drinking water, the cleanup standard for benzene becomes more stringent at 5 ppb.

In order to expedite the clean up of hazardous waste sites on Department of Defense (DOD) installations within the State of Missouri and ensure compliance with the applicable laws and regulations of the State, DOD and the Missouri Department of Natural Resources (MDNR) entered into an agreement known as the Department of Defense and State Memorandum of Agreement (DSMOA). Under the DSMOA, MDNR plans to review documents and activities produced as a result of efforts conducted by the DOD to identify and remediate uncontrolled hazardous waste/substances sites. As part of MDNR's Scope of Work, they are to identify and explain the State's ARARs.

4.2.2 Location-Specific ARARs

Location-specific ARARs are utilized for the protection of certain locations, such as floodplains, wetlands, or sensitive habitats. As stated previously, these ARARs would restrict the concentration of a hazardous substance that may be disposed in a location, or restrict the remedial actions conducted at a location. No location-specific ARARs have been identified for the Fire Valve Area at this time; however, wetlands are present on the Richards-Gebaur AFB.

Wetlands are defined by the U.S. Army Corps of Engineers as "those areas that are inundated or saturated by surface or groundwater at frequency and durations sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils". The majority of jurisdictional wetlands in the United States meet three wetland delineation criteria (hydrophytic vegetation, hydric soils, and wetland hydrology), and are subject to Section 404 of the Federal Clean Water Act. Areas that are periodically wet but do not meet all three criteria are not jurisdictional wetlands. Areas that have been disturbed or that are classified as problem area wetlands, but do not meet all three criteria as a result of natural or man-induced reasons, are still considered wetlands. Wetlands present on the Richards-Gebaur AFB meet the wetland delineation criteria but are non-jurisdictional.

The wetlands are located along natural drainages within the region. One wetland area has been identified east of the corrosion control building and is characterized as wooded with open patches of sedges. The other wetland area is adjacent to the POL tank farm and is dominated by cattails with intermittent patches of black willow where surface flow is reduced

4.2 3 Action-Specific ARARs

Action-specific requirements are established for the selected remedial alternatives for a site. They may determine performance levels, actions, or technologies and certain levels for discharged or residual contaminants. Potential action-specific ARARs include, among others, Occupational Safety and Health Act (OSHA), Clean Air Act, Hazardous Materials Transportation Act, Solid Waste Disposal Act, and Missouri regulations. Action-specific ARARs have not been identified

in this PA/SI but would be required in the event that remedial/removal activities were to occur for the Fire Valve Area.

4.3 Toxicity Assessment

The major contaminant of concern detected during this investigation is TPH. Toxicity data regarding TPH are not available. The source of the TPH contamination is probably related to a diesel, fuel oil, or JP-4 (jet fuel) spill. Described below are brief summaries of the human health hazards associated with fuel oil and jet fuel as obtained from The Installation Restoration Program Toxicology Guide (Oak Ridge National Laboratory, July 1989).

Fuel Oil

For short-term exposures, the primary systemic effect is central nervous system (CNS) depression. Inhalation of high concentrations may cause headaches, nausea, confusion, drowsiness, convulsions, and coma. Ingestion may cause nausea, vomiting, and in severe cases, drowsiness progressing to coma. Aspiration may cause extensive pulmonary injury. The liquid may produce skin irritation and dermal adsorption may induce nephropathy.

Long-term effects include kidney damage (as observed in animal studies) and CNS depression and dermatoses. The effects are negative for pregnancy and neonate data, and only limited evidence of genotoxicity effects. The International Agency for Research on Cancer (IARC) has not assigned a carcinogenic classification for fuel oils; however, studies through National Toxicology Program (NTP) have shown carcinogenicity of marine diesel fuel to mice.

Jet Fuel

The signs and symptoms of short-term human exposures to high vapor levels can cause irritation of the respiratory tract, headaches, nausea, and mental confusion. In extreme cases, loss of consciousness can occur. Ingestion is irritating to the stomach and aspiration of the liquids into the lungs can give rise to chemical pneumonitis. The liquid may cause defatting, drying, and irritation of the skin while both the vapor and the liquid are irritating to the eyes.

Long-term effects of jet fuel show liver and kidney damage (animal studies), and neurological damage. Data are not available on the effects to pregnancy or neonate. Limited data have shown negative effects on genotoxicity effects. Data are not available for a carcinogenicity classification by IARC, NTP, or EPA.

4.4 Risk Characterization

Quantitative estimates of human health risks associated with the contaminants of concern are beyond the scope of the work for this PA/SI. Several potentially complete exposure pathways were identified in the Fire Valve Area and were associated with contaminants detected in soils. On the basis of these findings, it cannot be determined whether direct soil contact or the release of contaminants from soils represent potential health hazards. However, since the impacted areas are relatively limited and only low contaminant concentrations were detected in soils, it does not seem likely that direct soil exposure or inhalation of airborne dusts and vapors represent substantial threats to human health. Also, since utility workers are likely to have infrequent

exposures to soils and exposures may be of short duration, it seems that risks may be minimal for these workers.

In addition, there are no ARARs available for soils with the exception of the State of Missouri cleanup levels for leaking USTs and ASLs. Only one soil sample exceeded the cleanup level for TPH compounds at a depth of 4.5 ft bgs. None of the volatile or semi-volatile compounds exceeded cleanup levels.

Chemical-specific ARARs do exist for groundwater beneath the Fire Valve Area. However, the groundwater exposure pathway is incomplete because the shallow aquifer is not used as a drinking water source. The Base obtains drinking water from the Missouri River through several pipelines from Kansas City. Also, it cannot be determined whether groundwater contamination has occurred because samples of the groundwater have not been obtained.

5.0 SUMMARY AND RECOMMENDATIONS

In summary, the source of the petroleum contamination in the Fire Valve Area appears to be related to a spill or release, possibly from past operations in Building 605. Based on the file review and records search, the petroleum contamination does not appear to be related to a leaking UST or AST. As observed during field activities, the source of contamination does not appear to be related to the abandoned POL line either, as the contamination was not observed continuously along either the water line or gas line, and remained in the area of the Building 605. The petroleum contamination appears to be confined to a portion of the water line trench southwest of Building 605. The contamination was not continuous within the water line trench as contamination was only detected in some of the borings along the water line. The discontinuous nature of the petroleum contamination may also be related to different spill events in the past.

The soil sampling program detected very low levels of ethylbenzene, xylene, and non-carcinogenic PAH compounds. Only one soil sample exceeded Missouri's LUST cleanup level for TPH, and the sample was collected at a depth of 4.5 feet bgs. The qualitative risk assessment identified utility workers conducting maintenance along the water line as the highest risk group in relation to the site's contaminants. However, the risk to this group would be minimal as maintenance would occur infrequently along the water line.

Based on the findings of the PA/SI, there are no significant impacts or risks to human health and the environment with respect to the soils in the Fire Valve Area. Therefore, the site is considered a Category I site and a No Further Response Action regarding the soils in the Fire Valve Area is proposed. However, the groundwater underlying the site was not investigated as part of the PA/SI and further action is recommended to determine whether the groundwater has been affected by the contaminated soil identified during the PA/SI. Additional data needs involve a better understanding of the groundwater system and the potential for groundwater contamination This would involve the installation and sampling of monitoring wells in the Fire Valve Area in upgradient and downgradient locations.

APPENDIX A

REFERENCES

REFERENCES

Burns and McDonnell. 1993. Final Work Plan, Hazardous Material Storage Area Richards-Gebaur AFB, Missouri.

CH2M Hill. 1983. Installation Restoration Program Records Search. Richards-Gebaur Air Force Base, Missouri.

Gentile, R.J. 1984. Geology of the Belton Quadrangle. Missouri Department of Natural Resources. Report of Investigations Number 69.

Missouri Department of Natural Resources. 1991. Missouri Site Characterization Guidance Document. Environmental Services Program, Jefferson City, MO.

Missouri Department of Natural Resources. 1992. Underground Storage Tanks Closure Guidance Document. Division of Environmental Quality, Jefferson City, MO.

O'Brien & Gere. 1991. Remedial Investigation at Richards-Gebaur Air Force Base for North Burn Pit, site FT002; Oil Saturated Area, site SS003; Hazardous Waste Drum Storage, site SS004; and POL Storage Yard, site ST005. Prepared for: Department of the Air Force, Headquarters Air Force Reserve, Robins Air Force Base, Georgia.

Richards-Gebaur AFB Basewide Environmental Baseline Survey. December 1993. (No Author provided).

Richards-Gebaur AFB Disposal and Reuse PDEIS; Internal Working Draft. December 1993. (No Author provided).

U.S. Department of Agriculture. 1984. Soil Survey of Jackson County, Missouri. Soil Conservation Service in Cooperation with the Missouri Agricultural Experiment Station.

U.S. Environmental Protection Agency. 1988. CERCLA Compliance With Other Laws Manual. OSWER Directive 9234.1-01. Office of Emergency and Remedial Response, Washington D.C.

U.S. Environmental Protection Agency. 1991. Guidance for Performing Preliminary Assessments Under CERCLA. PB92-963303. Office of Emergency and Remedial Response, Washington D.C.

U.S. Environmental Protection Agency. 1992. Guidance for Performing Site Inspections Under CERCLA. EPA/540-R-92-021. Office of Emergency and Remedial Response, Washington D.C.

APPENDIX B

STATEMENT OF WORK

STATEMENT OF WORK

PRELIMINARY ASSESSMENT/SITE INVESTIGATION OF IRP SITE SS009 AND ASSESSMENT OF DRAINAGE POND - AT RICHARDS-GEBAUR AFB. MO

I. DESCRIPTION OF WORK

1.1 Introduction

1.1.1 Background: The Fire Valve Area. Site SS009. is located at the edge of the Civil Engineering Complex. directly behind (south side) building 605. During excavation by an Air Force contractor in March 1992 to repair an underground water main valve. petroleum product in a liquid state was discovered. The trench soils were tested and contaminant levels exceeded the cleanup action levels listed below.

Compound	Standard
Benzene	1 mg/kg
Ethylbenzene	10 mg/kg
Toluene	5 mg/kg
Xylene	10 mg/kg
Total Petroleum Hydrocarbons (TPH)	200 mg/kg

The source of the petroleum discovered in the trench has not been determined. Approximately 10 cubic yards of soil were removed. The excavation was backfilled with clean fill. The area has now been identified for investigation under the Air Force Installation Restoration Program.

The drainage pond (approximately 36.000 SF in surface area) is located on the north side of the base. east and uphill from the base POL storage complex. This pond is a detention basin that receives discharges from floor drains of various shops. as well as discharges from surface runoff and stormwater sewers in the flightline and industrial areas of the base. The pond water and sediments may be contaminated from industrial waste discharges which may have bypassed the industrial waste treatment plant or from past. unrecorded spills throughout the base. The effluent from the pond passes through an oil/water separator before discharging to the Little Blue Valley Sewer District. During extreme runoff conditions the effluent due to the storm surge may bypass the oil/water separator. The pond and associated sediments have been identified for assessment under the Air Force Environmental Compliance Program.

1.1.2 Requirements for Project Activities. The Handbook To Support The Installation Restoration Program (IRP) Statements Of Work Handbook provides guidance for laboratory and field activities and applicable formats for project documents. The Handbook. dated May 1991. is provided as Government Furnished Information (GFI) under separate cover. This document is referenced in this Statement of Work as the Handbook. The contractor is responsible for the thorough knowledge and understanding of the previous findings and recommendations that affect this task prior to the start of field activities. The contractor shall comply with the specifications. procedures. and methodologies presented in the Defense and State Memorandum of Agreement. FY 91 with Missouri. appropriate excerpts provided as GFI under separate cover and appropriate Missouri Department of Natural Resources (MDNR) regulations and applicable USEPA Region VII regulations. The Contracting Officer (CO). the Contracting Officer's Representative (COR). the Base Point of Contact (POC). and Headquarters Air Force Reserve (HQ

AFRES/CEV) POC shall be notified in writing prior to any modification of, or deviation from, any activity described in these documents.

1.1.2.1 **Data Collection, Sampling, and Analysis Procedures.** The contractor shall conduct field activities, sampling, laboratory analysis and data quality assessment in accordance with the Missouri Department of Natural Resources (MDNR) requirements. Where MDNR does not provide guidance for a particular activity the procedures specified in the Handbook shall be followed. The contractor shall conduct all activities in accordance with the project Work Plan. The COR shall be notified in writing of any planned deviation from the activities specified in these documents. The COR approval of deviations is required prior to performance.

The field investigation (including all drilling and sampling operations) shall be supervised by a State registered geologist, hydrogeologist or professional geotechnical engineer. If required by the state, the on-site field supervisor shall be certified by the state to install test wells. A detailed log of field conditions, materials penetrated during drilling, well completion and sampling conditions, as described in section 2 of the Handbook, shall be maintained and made available for Government inspection upon request. Decisions on well and boring locations, well depths, screened intervals and all details of the field investigation shall be made collectively by the COR, Richards-Gebaur AFB Point of Contact (POC) and the contractor's field or project supervisor.

1.1.2.2 **Regulatory Requirements and Permits.** All well drilling, development, sampling, laboratory analysis, and other activities pursuant to this effort shall be conducted in strict accordance with all applicable laws, ordinances, rules, and regulations of federal, state, and all authorities with jurisdiction over such activities. The contractor shall obtain permits, applications, other documents, and proficiency tests required by the regulatory agencies. The contractor shall file documents with appropriate agencies and pay all applicable permit and filing fees. The contractor shall identify locations requiring permits to Richards-Gebaur AFB POC fourteen (14) days before permits are required. The contractor must coordinate digging permits with the Base POC prior to digging or drilling operations. The contractor shall include all correspondence in appendices to the technical reports in accordance with section 4 of the Handbook.

All laboratory analyses shall conform to all applicable federal, state, and local regulatory agency requirements. If the requirements specify that certification is necessary to conduct one or more specific analyses, the contractor shall furnish documentation showing laboratory certification to the COR prior to submitting samples to the laboratory.

The contractor shall containerize and sample materials or wastes produced by the contractor's actions which are suspected to be hazardous, or require special handling or disposal in accordance with applicable RCRA and Department of Transportation (DOT) requirements, the Handbook, and the contractor's approved plans. If a conflict between these requirements arises, the RCRA and DOT requirements shall prevail over the Handbook or the contractor's approved plans. Annex A includes estimates of the analyses which may be required for containerized materials or waste. The contractor shall transport these containerized materials to a location within the installation boundary designated by the Richards-Gebaur AFB POC for proper storage until the contractor can properly dispose of the containerized materials or waste in accordance with applicable federal, state, and local RCRA and DOT laws via Uniform Hazardous Waste (HW) Manifest. The contractor shall transport these materials/wastes off base no later than 30 days after the determination of the characteristics of the materials/wastes. The contractor shall transport and empty containerized materials determined not to be hazardous or require special handling or disposal to locations within the installation boundary identified by the Richards-Gebaur AFB POC.

1.1.2.3 **Quality Assurance/Quality Control (QA/QC).** A QA/QC program shall

be conducted and documented for all work pursuant to this delivery order in accordance with section H, paragraph 27 of the basic contract. Contractor and project-specific documents concerning QA/QC procedures and requirements shall be strictly followed. Data generated under the QA/QC program shall be quality assessed in accordance with Section 2.3 of the Handbook by the contractor to identify which data qualifies for use in risk assessment and remediation alternative screening.

1.1.2.4 **Special Notification.** The contractor shall immediately report to the COR and the Richards-Gebaur AFB POC, via telephone, any data or results generated during this investigation which may indicate an imminent health risk. Following this telephone notification, a written notice with supporting documentation (e.g. lab results, field data) shall be prepared and delivered within three (3) days. Upon request of the Air Force, the contractor shall submit the appropriate raw laboratory data (e.g. chromatograms) within three (3) weeks of the telephone notification (Sequence No. 16).

1.2 Project Activities

The contractor shall conduct the following tasks to achieve the purposes stated herein, in accordance with approved scoping documents, the Handbook, and all applicable statutes, regulations, and requirements. Many of these tasks result in specific components of reports, letters, plans, or other deliverables due from the contractor as specified in paragraph 1.3 Project Deliverables.

1.2.1 **Literature Search.** The contractor shall conduct a literature review and personnel interviews to: 1) identify potential sources of contamination for these sites; 2) obtain information to determine whether the sites are subject to other Federal or State authority; 3) obtain facility waste generation and manufacturing process descriptions which may have been sources of contamination for these sites; 4) obtain background and environmental setting information; 5) obtain information about the locations and characteristics of other potential areas of concern related to these sites; 6) identify data gaps and the need for additional information.

The contractor shall interview civilian and military personnel currently working at Richards-Gebaur AFB to gather additional information regarding past and present hazardous material and waste management practices at Richards-Gebaur AFB. If necessary, the contractor shall also interview former civilian and military Richards-Gebaur AFB personnel. Interviews shall be conducted via telephone; local interviews may be conducted in person. The Richards-Gebaur AFB POC will assist the contractor with identification of appropriate current and former personnel for inclusion in the interview process.

1.2.2 **Field Investigation** The contractor shall conduct a site investigation to characterize environmental conditions, define the nature and extent of any contamination, and qualitatively estimate the risk to human health and the environment at these sites, through the collection of geologic and hydrologic data, and environmental samples, the laboratory analysis of those samples for potential contaminants, the evaluation of the analytical results and field measurements with respect to quality control data, and the interpretation and analysis of accurate and precise data. The purpose of data collection, sample collection and laboratory analysis is to determine whether any contaminants generated from installation activities have entered the environment. The field investigation is used to determine the source of any identified contaminants, and the magnitude of contamination relative to Applicable or Relevant and Appropriate Requirements (ARARs) and any naturally occurring or background concentrations for specific compounds. The field investigation shall comply with the specifications, procedures, and methodologies presented in each of the contractor's approved work plans. The Contracting Officer (CO), the Contracting Officer's Representative (COR) and the Richards-Gebaur AFB POC must be

notified in writing and approval granted prior to any modification of, or deviation from, any activity described in these documents.

1.2.2.1 **Subsurface Sampling.** Drill soil borings with hand augers to a maximum depth of five (5) feet or to a maximum depth of one-hundred (100) feet with a power-driven sampling system. The estimated number of borings, analytical methods, parameters for analysis, number of analyses for soil samples, and field Quality Control (QC) requirements for soil samples are listed in Annex A.

a. **Lithological Samples.** The contractor shall describe core samples at least every five (5) feet of drilling and at each change in lithology. Follow the standard identification practices detailed in the Handbook. Include observations made by the driller and rig geologist during drilling such as depth to water, penetration rate, drill rig behavior, and other observations that might be indicative of changes in formation characteristics.

b. **Drill Cuttings and Drill Fluid.** The contractor shall containerize all drill cuttings and drill fluids. All drill cuttings and drill fluids shall be managed and disposed of in accordance with the AFCEE approved work plan. The contractor shall be responsible for providing all necessary containers for the drill cuttings, fluids and soils produced. The contractor shall be responsible for the handling, storing, and disposal of all drill fluids and drill cuttings deemed hazardous in accordance with current DOT and federal, state and local hazardous waste disposal laws. All hazardous waste shall be transported by the contractor to a licensed RCRA approved facility before 30 days of storage transpires and be accompanied by a Uniform Hazardous Waste Manifest. The contractor shall provide a final completed copy of the hazardous waste manifest to the Richards-Gebaur AFB POC. The contractor shall notify the Richards-Gebaur AFB POC of the need for manifest document signature forty-eight (48) hours prior to transport of the hazardous waste and the name of the RCRA approved facility where the waste is disposed.

c. **Water-Level Measurements in Boreholes.** Whenever possible the contractor shall measure water levels in all boreholes after the water level has stabilized. Include this information and the date of measurement in the boring logs. Also record soil moisture conditions (moist, wet, saturated, etc.) in the boring log.

d. **Sampling Location Precautions.** Mark the field locations of all borings/probes during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize the disruption of base activities, to properly position wells with respect to site locations, and to avoid penetrating underground utilities. Obtain all permits prior to commencement of digging and drilling operations. Boring/probe and other sampling locations shall be clearly identified in the field using a compass and surveyor's tape from a maximum of four (4) appropriate landmarks. Record the positions and the landmarks used on project and site specific maps.

e. **Sampling Sites.** Clean the general area following the completion of each well/borehole or other field activity. Contractor shall reasonably restore all sites to their pre-investigative condition (including, but not limited to, re-establishment of turf grasses, patching of pavement).

f. **Alternative Techniques for subsurface investigation.** The use of soil gas probes, hydraulically driven sampling probes, and other similar sampling techniques should be considered in lieu of traditional borings to reduce cost. Any surveys using such sampling probes shall be specified in the contractor's work plan.

1.2.2.2 **Survey for Utility Clearance.** The contractor shall perform a site survey which will include a review of Richards-Gebaur AFB drawings and contact with base civil

engineering and local utility companies to evaluate the location of existing underground utilities in the affected area. This survey shall include coordination with base personnel to field-verify the location of underground utilities. The contractor shall complete and coordinate required digging permits with the Base POC.

1.2.2.3 **Surface Water, Soil, and Sediment Samples.** The estimated number of samples to be collected, estimated number of analyses for each parameter and required analytical method is given in Annex A.

1.2.2.4 **Field Screening Activities.** Field Analytical Screening and Reconnaissance (FASR) should be considered and used where appropriate. FASR techniques can be used to identify hot spots, identify clean areas representative of background conditions, characterize heterogeneity, aid in development of sampling and analysis strategy and well/boring location. Compositing of samples should also be considered to reduce costs. All proposed FASR activities shall be specified by the contractor in the work plan.

1.2.2.5 **Transporting and Disposing Wastes.** The contractor shall be responsible for the handling, storing, and disposal of all wastes generated by the investigation. The contractor shall containerize all sampling materials and wastes suspected to be hazardous in accordance with applicable requirements, the Handbook, and the approved work plans. The contractor shall sample any wastes suspected to be hazardous in accordance with state and federal requirements for waste characterization prior to disposal. The contractor shall furnish all containers, services, and permits in support of disposal actions. The contractor shall transport these containerized materials to a location within the installation boundary designated by the Richards-Gebaur AFB POC for temporary storage. All hazardous waste shall be transported by the contractor to a licensed RCRA approved facility before 30 days of storage transpires and be accompanied by a Uniform Hazardous Waste Manifest. The contractor shall provide a final completed copy of the hazardous waste manifest to the Richards-Gebaur AFB POC. The contractor shall notify the Richards-Gebaur AFB POC of the need for manifest document signature forty-eight (48) hours prior to transport of the hazardous waste and the name of the RCRA approved facility where the waste is disposed.

1.2.3 **Meetings.** The contractor shall attend meetings as required by this SOW. An estimated two contractor personnel, including the project leader, shall attend an estimated four meetings at Richards-Gebaur AFB, MO. Each meeting is estimated to be six hours in duration. All meetings shall be coordinated by the COR.

1.2.4 **Conceptual Site Model.** For each site, use data supported by acceptable QA/QC results (as measured against QAPP requirements) and site characterization information to develop the conceptual site model. The model shall illustrate the nature and extent of contamination and the transport and fate of those contaminants. The minimum requirements of the model are given in section 2 of the Handbook. The complexity and detail of the site model shall be consistent with the nature of the site and site problems, and the amount of data available and must include the determination of background concentrations. Use the conceptual site model in the risk assessment. Conceptual site models shall be included in the technical reports (see para 1.3.4). Other deliverables shall include all or part of each conceptual site model as appropriate for the effort.

1.2.5 **Risk Assessment.** For each site, use data supported by acceptable QA/QC results (as measured against QAPP requirements) and the conceptual site model to estimate qualitatively the risk posed by site contaminants to public health and the environment. Use the methodology in section 2 of the Handbook. Identify all Applicable or Relevant and Appropriate Requirements (ARARs) for those contaminants detected in environmental samples at each site. Provide the results of the qualitative risk assessment in the Technical Report using the formats in

section 4 of the Handbook.

1.2.6 **Technical Reports.** Upon completion of the field effort, the contractor shall prepare a technical report for each site. These summary reports shall at a minimum discuss (1) Site history; (2) waste descriptions; (3) pathway characteristics; and (4) Receptors. The reports shall be prepared following appropriate formats specified in the Handbook. Where guidance is lacking or not appropriate in the Handbook, the contractor shall follow EPA guidance documents such as the Guidance set forth in OSWER Directive 9345.0-01, Section 2.0, "Guidance for Conducting New PAs," and "RCRA Facility Assessment Guidance (October 1986)". The contractor shall prepare an outline for approval prior to writing the first draft report.

1.2.7 **Documentation.** All information sources for the PA/SI and the detention pond site assessment shall be appropriately documented and provided with the Technical Reports as an attachment, references, appendix, or bibliography.

1.3 Project Deliverables

Deliver the following documents in compliance with the requirements of item VI, the formats required in sections 1 and 4 of the Handbook, and the specifications noted below. With the exception of working drafts which are considered "in progress", draft reports are considered "drafts" only because they have not been reviewed and approved by the Air Force. In all other respects, "drafts" shall be complete, in the proper format, fully illustrated, and free of grammatical and typographical errors.

1.3.1 **Engineering Network Analysis.** Provide a computer generated network analysis which is a detailed task plan for all tasks for approval by the COR. The Network Analysis (GANTT, PERT, CPM) shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period of the delivery order. The Network Analysis (GANTT, PERT, CPM) shall show both serial and parallel subtasks leading to a deliverable product or report (drafts as well as final). Show early and late start and completion date with float. Update and submit monthly (Sequence No. 3).

1.3.2 **Work Plan.** The contractor shall provide a separate work plan for each site describing all phases of work planned. The work plan shall include, but not be limited to, investigation objectives, a schedule of activities, a Health & Safety Plan, a Sampling and Analysis Plan, and a listing of all State, Federal, and local regulations governing field work and laboratory investigation. Approval of the work plan is required prior to the start of field work for the site. The format of the work plan shall follow the guidance included in the Handbook. Where guidance is lacking or not appropriate in the Handbook, the contractor shall follow EPA guidance documents such as the Guidance set forth in OSWER Directive 9345.0-01, Section 2.0, "Guidance for Conducting New PAs," and "RCRA Facility Assessment Guidance (October 1986)". The contractor shall provide a proposed outline of each Work Plan for approval prior to writing the first draft. (Sequence No. 4.)

1.3.3 **Letter Reports.** The contractor shall prepare an estimated eight letter reports as directed by the COR. Assume for costing purposes a total of 120 pages. The purpose of the letter reports is to provide data and the contractor's evaluation of the data to enable the COR and base POC to be involved in the decisions based on that data. The letter shall briefly describe the task performed, the contractor's evaluation of the data collected, and recommendations for subsequent tasks. All data collected as part of this task shall be provided as an attachment to the letter (Sequence No. 3).

1.3.4 **Technical Reports.** Summarize the findings of the current task, and formulate

conclusions and recommendations for future efforts in two Technical Reports following the approved formats. One PA/SI report for site SS009 and one Assessment report for the detention pond site shall be prepared. The contractor shall provide a proposed outline of each report for approval prior to completing the working draft. (Sequence No. 4).

1.3.5 **No Further Action Decision Documents** For those sites requiring no further action, the contractor shall provide a decision document in the form of an application to terminate the process. (Sequence No. 4).

1.3.6 **Analytical Data ITIR.** Submit all analytical data, including QC results and cross reference tables, in an ITIR. Use the format in section 4 of the Handbook. (Sequence No. 3).

1.3.7 **Project Definition ITIR.** For those sites identified by the COR during this effort, the contractor shall prepare a Project Definition ITIR. Assume for costing purposes, a total of 50 pages for each reports. This document shall contain at a minimum a Site Characterization Summary and all available qualitative and quantitative information necessary to define requirements for site remediation (e.g., construction requirements, volume of contaminated soil, etc.). Prior to preparation of this document, the contractor shall submit an annotated outline for content and format approval by the AFCEE COR. (Sequence No. 3).

II. Base Support

The base will:

2.1 Issue digging or other appropriate permits to the IRP contractor prior to the commencement of digging, drilling, or probe installation operations.

2.2 Assign accumulation points within the installation to which the contractor can deliver any drill cuttings, well installation/development fluids, or other sampling wastes generated from the required work which are suspected to be hazardous. However, the base will not be responsible for providing any necessary containers (e.g. 55-gallon drums). The base will not be responsible for transporting the containerized material to the accumulation point. The base will not provide for the ultimate transport and disposal of the wastes generated under this delivery order (see paragraph 1.2.2.4).

2.3 Provide to the contractor existing engineering plans, drawings, diagrams, aerial photographs, etc., to facilitate evaluation of sites under investigation.

2.4 Arrange for the following:

a. Personnel identification badges, vehicle passes, and/or entry permits within one week of written notification of personnel's names, citizenship, and state of birth for American citizens.

b. A staging area (approximately 1,000 square feet) for storing equipment and supplies. The security of the equipment shall be the contractor s responsibility.

c. A supply (e.g., fire hydrant, stand pipe, etc.) of large quantities of potable water for equipment cleaning, etc. Use of fire hydrant will be coordinated by Base POC within ten working days of written notification of first day of anticipated use.

d. A paved area where drilling equipment can be cleaned and decontaminated. A source of potable water (i.e., ordinary outdoor water faucet) and a 110/115 VAC electrical outlet must be available within 25 feet of the paved area for steam cleaner hookup. Drainage from this area should be through an oil/water separator to a sanitary sewer.

e. A set of keys to the locks on any existing test/monitoring wells as appropriate to the sites being investigated.

III. Government Furnished Property/Information:

3.1 The Handbook To Support The Installation Restoration Program (IRP) Statements Of Work. Volume 1 referenced in this Statement of Work provides requirements for laboratory and field activities and applicable formats for project documents that shall be used by the contractor unless otherwise specified in this Statement of Work. The latest version of the Handbook is dated May 1991.

IV. Government Points of Contact:

4.1 AFCEE

Contracting Officer's
Representative (COR):
Capt J. Bradley Beck
AFCEE/ESB
8001 Inner Circle Dr. Ste 2
Brooks AFB TX 78235-5328
(210) 536-5274
DSN 240-5274

4.2 Base and HQ AFRES Points of Contact

Base Point of Contact (POC):
Mr Tom Pilcher
442 SPTG/CE
Richards-Gebaur AFB MO 64147
(816) 348-2091
DSN 463-2091

HQ AFRES POC
Mr Mark Esch
HQ AFRES/CEV
155 2nd St
Robins AFB. GA 31098-1635
(912) 926-1077
DSN 497-1077

V. Deliverables

5.1 Attachment 1 of the Basic Contract

Sequence numbers 1 and 5 listed in attachment 1 to the basic contract apply to all orders. Guidance for preparing R&D Status Reports (Sequence No. 1) is contained in the Handbook, section 4. In addition, the sequence numbers and dates listed below are applicable to this order:

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
16 (Special Notification)	I.1.1.2.4	OTIME	a	-	-	b
3 (Net. Anal.)	I.1.3.1	MTHLY	a	7 DADO	c	c
4 (Work Plan Outlines)	I.1.3.2	ONE/R	a	7 DADO	-	3
4 (Work Plans)	I.1.3.2	ONE/R	a	30 DADO	d	d
3 (Letter Reports)	I.1.3.3	ASREQ	a	e	e	e
4 (Tech Report Outlines)	I.1.3.4	ONE/R	a	f	f	f
4 (Tech Reports)	I.1.3.4	ONE/R	a	f	f	f
4 (NFA Dec. Docs)	I.1.3.5	ONE/R	a	g	g	g
3 (Data ITIR)	I.1.3.6	OTIME	a	h	--	3
3 (Project Definition ITIR)	I.1.3.7	ONE/R	a	i	i	i

5.2 Notes

DADO = Days After effective date of the Delivery Order

a Date of Preparation

b Provide written notice with supporting documentation within three days of telephone notification and at the direction of the COR. For costing purposes, a total of one, 10 page notification is estimated.

c Submit monthly thereafter. Provide 2 copies to COR, 2 copies to Base POC, and an estimated 3 additional copies to be distributed as specified by the COR.

d An estimated one working draft (5 copies), one draft (10 copies), and one final (15 copies) of each work plan are required. Incorporate Air Force comments as directed by the COR to produce the second draft and final plans. Assume a 4 week Air Force review period. Draft and final plans are due no later than 15 days after receipt of comments. Supply the COR with an advance copy of the working draft, draft, and final plans for acceptance prior to distribution. Distribute the remaining copies of the plans as specified by the COR.

e An estimated 2 copies shall be submitted to the COR. Submittal dates shall be coordinated with the COR.

f Technical report outline is due no later than 10 days after approval of the work plan. Provide three copies of the outline. Provide an estimated three copies of the outline. Technical report working draft is due no later than 90 days after approval of the work plan. An estimated one working draft report (10 copies), one draft report (15 copies), and one final report (25 copies) are required. Incorporate Air Force comments to produce the second draft and final reports as specified by the COR. Assume a 4 week Air Force review period. Draft and final reports are due no later than 30 days after receipt of comments. Supply the COR with an advance copy of the working draft, draft, and final reports for acceptance prior to distribution. Distribute the remaining copies (one of the final report copies shall be microfiche) as specified by the COR.

g An estimated one draft (5 copies) and one final (15 copies) of each decision document is required. The initial submittal is due concurrently with submission of the draft technical report (see note f above). The final decision document is due concurrently with the final technical report. Supply the COR with one (1) advance copy of each draft and final decision document for acceptance prior to distribution. Incorporate Air Force comments into the final decision document as specified by the COR. Assume a 4 week Air Force review period. Distribute the remaining copies of the final decision documents as specified by the COR.

h Provide the analytical data ITIR upon completion of the total analytical effort and not later than three weeks after all analyses have been completed.

i Provide the project definition outline concurrently with the working draft of the technical report. Provide an estimated three copies of the outline. An estimated one draft (5 copies) and one final (10 copies) of the project definitions are required. The initial submittal is due concurrently with submission of the draft technical report (see note f above). The final submission is due concurrently with the final technical report. Incorporate Air Force comments to prepare the final document. Assume a 4 week review period. Supply the COR with an advance copy of the final for acceptance and distribute the remaining copies as specified by the COR.

Annex A, Table A-1
Specifications and Estimate of Proposed Field Work

Estimated Number of Wells	2
Estimated footage of each well	20
Estimated Number of Groundwater Samples	3

Monitoring Well Construction (wells assumed to be constructed from soil borings)

Boring Method	Contractor's choice
Borehole Geophysical Logs	Required
Soil Sampling Interval for	
Lithology Profile	every 5 feet and at changes in lithology
Well Casing	
Type of Material	PVC suggested
Schedule/Grade	40
Inside Diameter	4 inch
Estimated Footage	10
Well Screen	
Type of Material	PVC suggested
Schedule/Grade	304
Inside Diameter	4 inch
Minimum Length	5 ft
Maximum Length	15 ft

Soil Gas Surveys and Other Field Screening	
Est Number of Probes	30
Soil Borings	
Est Number of Borings	4
Estimated footage of each boring	20
Estimated number soil samples for chemical analysis	16
Hand Auger Soil Borings	
Estimated Number of Locations	8
Estimated Number soil samples for chemical analysis	24
Estimated Number of Sediment Samples	10
Estimated Number of Surface Water Samples	8

Richards-Gebaur AFB, PA/SI & Assessment
Annex A, Table A-2
Analytical Methods and Estimated Number of Soil Analyses

Parameter	Analytical Method	Reporting Units	Number of Analyses	Trip Blanks	Ambient Blanks	Equip. Blanks	Dup./Rep.	Second Column	Total Analyses
Total Petroleum Hydrocarbons	SW3550/ E418.1	mg/kg	50	-	-	-	5	-	55
ICP Screen (25 metals)	SW3050/ SW6010	mg/kg	50	-	-	-	5	-	55
Mercury	SW7471	mg/kg	50	-	-	-	5	-	55
Organochlorine Pesticides and PCBs	SW3550/ SW8080	mg/kg	5	-	-	-	1	3	9
Volatile Organic Compounds	SW5030/ SW8240	mg/kg	5	1	-	-	1	-	7
Semivolatile Organic Compounds	SW3550/ SW8270	mg/kg	5	-	-	-	1	-	6
Soil Moisture Content	D2216	%	50	-	-	-	-	-	50

Richards-Gebaur AFB, PA/SI & Assessment
Annex A, Table A-3
Analytical Methods and Estimated Number of Water Analyses

Parameter	Analytical Method (a)	Reporting Units	Number of Analyses	Trip Blanks	Ambient Blanks	Equip. Blanks	Dup /Rep.	Second Column	Total Analyses
Specific Conductance	E120 1	µmhos/cm	11	-	-	-	-	-	11
pH (Field Test)	E150 1	pH units	11	-	-		-	-	11
Temperature (Field Test)	E170 1	deg C	11	-	-	-	-	-	11
Alkalinity (total)	A403	mg/l	11	-	-	-	-	-	11
Total Petroleum Hydrocarbons	E418 1	mg/l	11	-	-	2	2	-	15
ICP Screen (20 metals, excl. Boron, Selenium, Lead, Arsenic, and Silica) (c)	SW3005/ SW6010	mg/l							
	TOTAL		11	-	-	2	2	-	15
Arsenic (c)	SW7060	mg/L							
	TOTAL		11	-	-	2	2	-	15
Lead (c,d)	SW3005/ SW7421	mg/l							
	TOTAL		11	-	-	2	2	-	15
Mercury (c)	SW7470	mg/l							
	TOTAL		11	-	-	2	2	-	15
Selenium (c)	SW7740	mg/l							
	TOTAL		11	-	-	2	2	-	15

110 78

Richards-Gebaur AFB, PA/SI & Assessment
Annex A, Table A-3 (cont'd)
Analytical Methods and Estimated Number of Water Analyses

Parameter	Analytical Method (a)	Reporting Units	Number of Analyses	Trip Blanks	Ambient Blanks	Equip. Blanks	Dup /Rep	Second Column	Total Analyses
VOCs	SW5030/ SW8240	ug/l	11	2	-	2	2	2	17
Organochlorine Pesticides and PCBs	SW3520/ SW8080	pg/l	2	-	-	-	1	1	4
Semivolatile Organic Compounds	SW3510/ SW8270	pg/l	7	-	-	-	2	-	9

Annex A, Table A-3 Notes:

a Unless an abbreviated list of analytes is specified under "Parameter" above, the analytical protocol shall include all analytes listed in the referenced analytical method. The methods cited are from the following sources:

"A" Methods Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985)

"E" Methods Methods for Chemical Analysis of Water and Wastes, EPA Manual, 600/4-79-020 (USEPA, 1983--with additions)

"SW" methods Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA, 1986)

"ASTM" Methods American Society for Testing and Materials, 1919 Race Street, Philadelphia, PA 19103

b If the number of samples requiring second column confirmation exceeds this allowance, contact the Technical Project Manager. The total number of samples listed in Annex A includes the allowance applicable to each GC method. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

c The sample shall be filtered in the field through a 0.45 µm filter immediately (within 5 min) after sample collection and before sample preservation.

d For furnace analyses, modify the SW3005 digestion procedure by substituting 5 ml concentrated nitric acid for the 5 ml concentrated hydrochloric acid specified by the method (a total of 7 ml nitric acid will be added).

110 80

APPENDIX C

BORING LOGS

BORING NUMBER B1

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *24 Mar 94*
DRILLING METHOD *5' Continuous Sampler, 6" (I.d.) HSA*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *14 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Asphalt and gravel base, sand fill
					0	2.5YR4/3			CLAY, greenish-grey – greenish-tan, mottled, plastic, dense, and slightly moist, some drk. grey/green (5YR3/2).
						5Y4/3			
X				5	0	5Y3/2	CH		
X						2.5YR3/1			Silty clay, drk grey/brown, roots (possibly former soil beneath fill) at 6 5 feet
									Starts grading into a tan color – 2.5Y5/3 at 7 1 feet
									Recovery compressed in sampler due to soft clay material.
									No Recovery
X				10	0	2.5Y8/4	CH		CLAY, grey to tan, mottled, plastic, dense, occasional black mineral inclusions, plus, chert/L S. fragments, weathered cobbles at base of interval, slightly moist
						5Y8/2			
X									Auger refusal at 14 feet.
				15					*Grouted with Portland Type I/bentonite on 24 Mar 94.*
				20					

110 83

BORING NUMBER B2

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *24 Mar 94*
DRILLING METHOD *5' Continuous Sampler, 6" (I.d.) HSA*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *14 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES Field GC	SAMPLES Analytical	SAMPLES Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Asphalt and gravel base plus tan, lean, clay
						5GY4/1			CLAY, lt. to drk greenish-grey (some tan, iron stains), dense, plastic to fairly plastic, slightly moist.
X						G2.5			
					>20	2.5Y5/4			
				5					
X						5Y2.5/1	CH		Becomes drk greenish-brown at 5.7 feet.
						5Y3/1			Becomes med greenish-brown at 7 feet
						2.5Y4/4			Becomes tan with occasional fragments and black mineral nodules
									No Recovery
				10					
					0	2.5YR6/4			CLAY, tan, plastic, and dense, slightly moist Presence of chert (wht /tan weathered) in 1" angular – subangular frag at 10 5 feet Platy weathered bedrock texture to clay with black mineral inclusions.
							CH		
X						5YR6/3			Becomes lt. grn/yel -tan, with weathered limestone fragments at base Auger refusal at 14 feet
				15					Grouted with Portland Type I/bentonite on 24 Mar 94
				20					

JOB NUMBER B2

BORING NUMBER B3

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *24 Mar 94*
DRILLING METHOD *5' Continuous Sampler, 6" (I.d.) HSA*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *14 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Gravel/Soil road base (shoulder of road)
							GC		Gravel and brown silty clay soil.
X					13	5Y4/2			CLAY, med to drk. greenish-brown, mottled, plastic, dense to fairly
X	■				7	5YR5/1	CH		dense, possibly compressed by rig, banded green to green/black
X					6				staining (5YR5/1), slightly moist, stronge hydrocarbon odor from 2'
									on, black maybe staining.
									No Recovery
				5					
X					0	5Y3/1			CLAY, same as above, mottled to banded, slight hydrocarbon odor
						5GY4/1			
X						5Y5/2			Changes from med green/brown to med greenish-tan, and mottled with
							CH		green/grey to orange/tan, harder then above
X						10YR4/6			Becomes tan/greenish-beige, with sub to angular chert and black
									mineral inclusions
X	■			10					Contains small angular chert inclusions Becomes mottled in
									orange/tan, green/beige, and drk green/grey
									No Recovery
									Auger refusal at 14 feet.
				15					Grouted with Portland Type I/bentonite on 24 Mar 94
				20					

BORING NUMBER B4

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *24 Mar 94*
DRILLING METHOD *5' Continuous Sampler, 6" (I.d.) HSA*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *14 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Gravel and soil fill at edge of asphalt pavement
					0	2.5YR4/3	CL		CLAY, silty with gravel, med reddish-brown.
					0	2.5YR3/2	ML		CLAY, drk. grey/green to green/brown, mottled, plastic and dense Some orange/tan iron stain (particularly at 3 feet).
							CH		
				5					No Recovery
									CLAY, same as above, becomes soft at 5 2 feet
									Becomes denser at 6 5 feet
									Clay starts to grade green/tan to orange/tan at 7 5 feet
									Mottled orange/tan, greenish-beige, greenish-pink/grey with inclusions of 1" chert frag from 8 to 9 feet
							CL		*Possible joint/fracture at 9 feet, slighty moist*
				10					Becomes wet
						2.5YS/4	CH		CLAY, tan, lean to silty, dry to slightly moist, platy texture
									No Recovery Auger refusal at 14 feet
				15					Grouted with Portland Type I/bentonite on 24 Mar 94
				20					

110 86

BORING NUMBER FSB1

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Augers*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
X				0	0		GC		Gravel and med. brown silty clay soil, dry.
									Increase in clay, drk. brown, moist, and plastic.
X				5					
							CH		CLAY, drk. green/brown to med tan/brown, plastic, moist, no odor but slight fluctuation in Hnu
X	■				>1				
				10					Grouted with Portland Type I/bentonite on 25 Mar 94
				15					
				20					

BORING NUMBER FSB2

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Augers*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
							GC		Gravel and med brown clayey soil
X					0		CH		CLAY, drk green/grey, plastic and moist.
X				5			CH		CLAY, tan, plastic, dense, and wet (water line leakage possibly).
X					0				This boring does not appear to be in the utility line trench
									Grouted with Portland Type I/bentonite 25 Mar 94
				10					
				15					
				20					

JOB NUMBER FSB2

BORING NUMBER FSB3

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
							GC		Gravel and silty clay soil fill
					2		CH		CLAY, drk green/grey, hydrocarbon odor (HNu 6 ppm in hole), plastic Becomes drk blue/green/grey, softer, moist with "sewer" odor (possible baterial degradation on hydrocarbons) at 3 feet
				5	0		CH		CLAY, tan, dense, saturated from shallow line leak, coated with wet drk grey, mud HNu – 13 ppm (benzene equivalents) in hole.
				10					Grouted with Portland Type I/bentonite on 25 Mar 94
				15					
				20					

BORING NUMBER FSB4

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass, and silty brown clayey soil
					0		OH		CLAY, med green to brown, plastic and moist
				5	0		CH		CLAY, tan, dense, plastic, only slightly moist
				10					Grouted with Portland Type I/bentonite on 25 Mar 94
				15					
				20					

JOB NUMBER FSB4

BORING NUMBER FSB5

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
							GC		Gravel and silty clayey soil
X					0		CH		CLAY, drk. bluish-green/brown, plastic soft, slightly moist, weak "sewer" odor
							CH		CLAY, tan, soft and plastic
X				5			CL		CLAY, lean to silty, crumbly, dry to slightly moist.
					0				Becomes more plastic from 7 to 8 feet
X									Grouted with Portland Type I/bentonite on 25 Mar 94
				10					
				15					
				20					

110 91

BORING NUMBER FSB6

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
							GC		Grass cover with silty clay with gravel backfill.
X					0		CH		CLAY, med-drk greenish-grey, soft, plastic. Becomes saturated [Auger was pushed to the side by a gas line, could see the pocket created by washed out sediment along bore hole wall next to the line - no odor (HC or "sewer"), 0 HNu at 5 feet in hole]
X				5	0		CH		CLAY, tan to orange to greenish-tan, plastic, dense, and saturated. Contains 1" sub to angular chert fragments at 8 feet
				10					Grouted with Portland Type I/bentonite on 25 Mar 94.
				15					
				20					

JOB NUMBER FS86

BORING NUMBER FSB7

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
							OH		Grass cover with topsoil, drk. brown to black brown, organic rich, clayey, plastic, and fairly dense
X							GP		GRAVEL, tan-orange/brown.
X				5		2.5YR2.5/1	CH		CLAY, very drk brown to black brown, organic mat'l, soft, plastic, and slightly moist.
									Becomes dark bluish-green/grey
X									Not much soil left on the bottom of the auger for a sample, most came up the augers as it rotated in the bore.
				10					*Grouted with Portland Type I/bentonite on 25 Mar 94.*
				15					
				20					

BORING NUMBER FSB8

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *25 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Asphalt and Gravel base, HNu – 3 ppm in the hole (no response to sample).
	X				0				CLAY, drk brown-black, fairly dense, plastic, slight hydrocarbon odor
									Becomes softer and more moist.
	X			5			CH		Becomes drk bluish-greenish-grey, plastic, moist, and soft
	X								Slight "sewer" odor at bottom
									Grouted with Portland Type I/bentonite on 25 Mar 94
				10					
				15					
				20					

JOB NUMBER FSB8

BORING NUMBER FSB9

PROJECT Richards Gebaur AFB, Fire Valve Area
DATE DRILLED 28 Mar 94
DRILLING METHOD 4" Solid Flight Auger
DRILLING COMPANY Layne-Western
SURFACE ELEV. Feet MSLD
TOTAL DEPTH 8 Feet
DEPTH TO WATER
GEOLOGIST J. Mead
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass and Topsoil.
X					0		CH		CLAY, drk. brown (desecending grade of reddish to black tint), plastic and soft, moist, and some gravel at top of interval
X				5	0	5Y2.5/1			At 4 feet, auger hit a line; moved 6 inches north. The samples of overlying clay were the same as above except color which was a drk. bluish-grey to blackish-green.
X					0		CH		CLAY, med tannish to greenish-grey, more dense, plastic, wet mud covered auger clay (line leakage)
				10					Grouted with Portland Type I/bentonite on 29 Mar 94
				15					
				20					

BORING NUMBER FSB10

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass cover and Topsoil, med reddish-brown to drk brown, loose
X					0	5YR2.5/1	CH		CLAY, drk reddish-brown, plastic, fairly dense, slightly moist, increases in moisture and softness with depth. Appears to be layered with a med. tan silty clay.
X					0		CH		CLAY, drk. bluish-reddish-grey/black, soft, plastic, and moist
X				5			CH		CLAY, med. tannish-grey, fairly soft, wet, and plastic.
X					0				
				10					Grouted with Portland Type I/bentonite in early April 1994 (Boring was missed when others were grouted on 29 Mar 94)
				15					
				20					

BORING NUMBER FSB11

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *10 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass and topsoil, silty clay, med. reddish-brown
X					0		CH		CLAY, drk. reddish-brown, fairly soft, plastic, and moist.
X				5	0				CLAY, med tan/brown, plastic, fairly denser, with occasional orange/tan inclusions or layers at 4 feet
					0		CH		Becomes a med grey-tan with orange/tan inclusions and layers, slightly moist at 5 feet
X					0				Presence of drk grey/brown layers and possible chert fragments at 8 feet
				10					Slight HNu deflection in hole (may just be moisture)
									Grouted with Portland Type I/bentonite on 29 Mar 94.
				15					
				20					

BORING NUMBER FSB12

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" CFA*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *15 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Asphalt and gravel base of parking lot, 8" thick
X					0		CH		CLAY, drk. brown/black, plastic to fairly plastic, soft, moist to slightly moist.
									Becomes a drk reddish-brown at 3 feet, med. greenish-tan clay at bottom of 3 to 5 foot interval
X				5	0	2.5Y4/1			
							CL		CLAY, tannish-grey/brown with some orange/tan clay, plastic, dense, stiff, and only slightly moist
X					0				
				10					
							CH		CLAY, med tannish-brown, fairly plastic, fairly dense, and more moist at 10 feet
					0				
X				15					
									Grouted with Portland Type I/bentonite on 29 Mar 94
				20					

BORING NUMBER FSB13

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD.

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass and topsoil, drk reddish-black/brown.
X					0		CL		CLAY, drk. reddish-brown, fairly plastic, slightly moist.
									Becomes a ltr greyish tint at 3 feet.
X				5	0				
							CH		clay, med. tannish-grey/brown, plastic, soft, and moist.
X					0				
									Grouted with Portland Type I/bentonite on 29 Mar 94
				10					
				15					
				20					

BORING NUMBER FSB14

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass and topsoil
					0		CH		CLAY, med -drk. reddish-grey/brown, plastic, fairly dense, moist. Becomes lighter grey with depth
				5	0	2.5Y4/2	CL		CLAY, med tannish-grey with orange/tan inclusions, fairly plastic and dense, slightly moist. Med grey and orange/tan layers are present, clayey and more dense. Becomes softer, more plastic, and moist with depth
					0				
				10					Grouted with Portland Type I/bentonite on 29 Mar 94.
				15					
				20					

BORING NUMBER FSB15

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Grass and Topsoil.
							CH		CLAY, med-drk. reddish-grey/brown, plastic, soft, moist
X					0				
									CLAY, med.-drk tannish to greyish-brown, plastic, soft and moist.
X				5	0		CH		Becomes med. greenish-tan/grey, and wet at 5 feet
					0				Slight HNu deflection in hole (probably moisture)
X									
									Grouted with Portland Type I/bentonite on 29 Mar 94
				10					
				15					
				20					

110101

BORING NUMBER FSB16

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *28 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER *2.8 Feet*
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Gravel and loose med. brown silty soil, nest to asphalt
									CLAY, med-drk grey/brown, plastic, soft, and moist
X					11				
									Becomes med greenish-blue/grey, HNu - 15 ppm in hole after augering to 3 feet
					>20?		CH		
X				5	<2	5Y3/1 5y4/1			Becomes med. grey, wet at 5 feet. HNu - 8 ppm in hole (rose to 12 later), one HNu reading of >2 ppm @ 5 feet of auger sample, other readings were <2 ppm
					0				
X							CH		CLAY, med tan, plastic, fairly dense, and moist HNu - 15 ppm (benzene equivalents) in hole after augering to 8 feet
									Grouted with Portland Type I/bentonite on 29 Mar 94.
				10					
				15					
				20					

110102

BORING NUMBER FSB17

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *29 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Gravel and soil next to asphalt road.
					2		CH		CLAY, med. tannish-grey/brown (greenish-grey @ 2'), plastic, fairly dense (softer @ 2'), moist, hydrocarbon odor, HNu - 3 ppm in hole after augering to 3 feet Becomes bluish/greenish-grey at 3 feet, hydrocarbon odor still present
				5	<1				
							CH		CLAY, med tan to grey/tan to orange/tan, mottled/layered, generally dense (some soft), moist, coated with wet grey clay, HNu up to 38 ppm in hole. HNu up to 6 5 ppm in hole after augering to 8 feet
				10					Grouted with Portland Type I/bentonite on 29 Mar 94
				15					
				20					

110103

BORING NUMBER FSB18

PROJECT *Richards Gebaur AFB, Fire Valve Area*
DATE DRILLED *29 Mar 94*
DRILLING METHOD *4" Solid Flight Auger*
DRILLING COMPANY *Layne-Western*
SURFACE ELEV. *Feet MSLD*
TOTAL DEPTH *8 Feet*
DEPTH TO WATER
GEOLOGIST *J. Mead*
X,Y COORD. ,

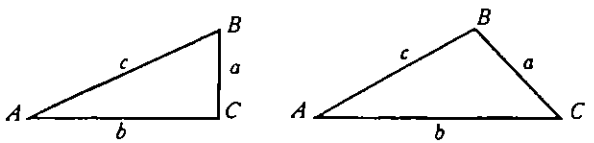
SAMPLES: Field GC	SAMPLES: Analytical	SAMPLES: Geotechnical	% RECOVERY	DEPTH feet	PID (ppm)	MUNSELL	SOIL CLASS	GRAPHIC LOG	DESCRIPTION AND REMARKS
									Gravel and med. brown silty soil next to asphalt road
									CLAY, med. tan, plastic, dense, slightly moist
X					0		CH		HNu – 0 in hole after augering to 3 feet.
X				5	0				HNu – 0 in hole after augering to 5 feet.
									CLAY, med orangish-tan, plastic, fairly dense, slightly moist.
					0		CH		HNu – 0 in hole after augering to 8 feet.
X									
				10					Grouted with Portland Type I/bentonite on 29 Mar 94.
				15					
				20					

JOB NUMBER FSB18

APPENDIX D

FIELD NOTES

FORMULAE FOR SOLVING RIGHT TRIANGLES



$\text{Sin } A = \frac{a}{c} = \text{Cos } B \qquad \text{Cot } A = \frac{b}{a} = \text{Tan } B$

$\text{Cos } A = \frac{b}{c} = \text{Sin } B \qquad \text{Sec } A = \frac{c}{b} = \text{Cosec } B$

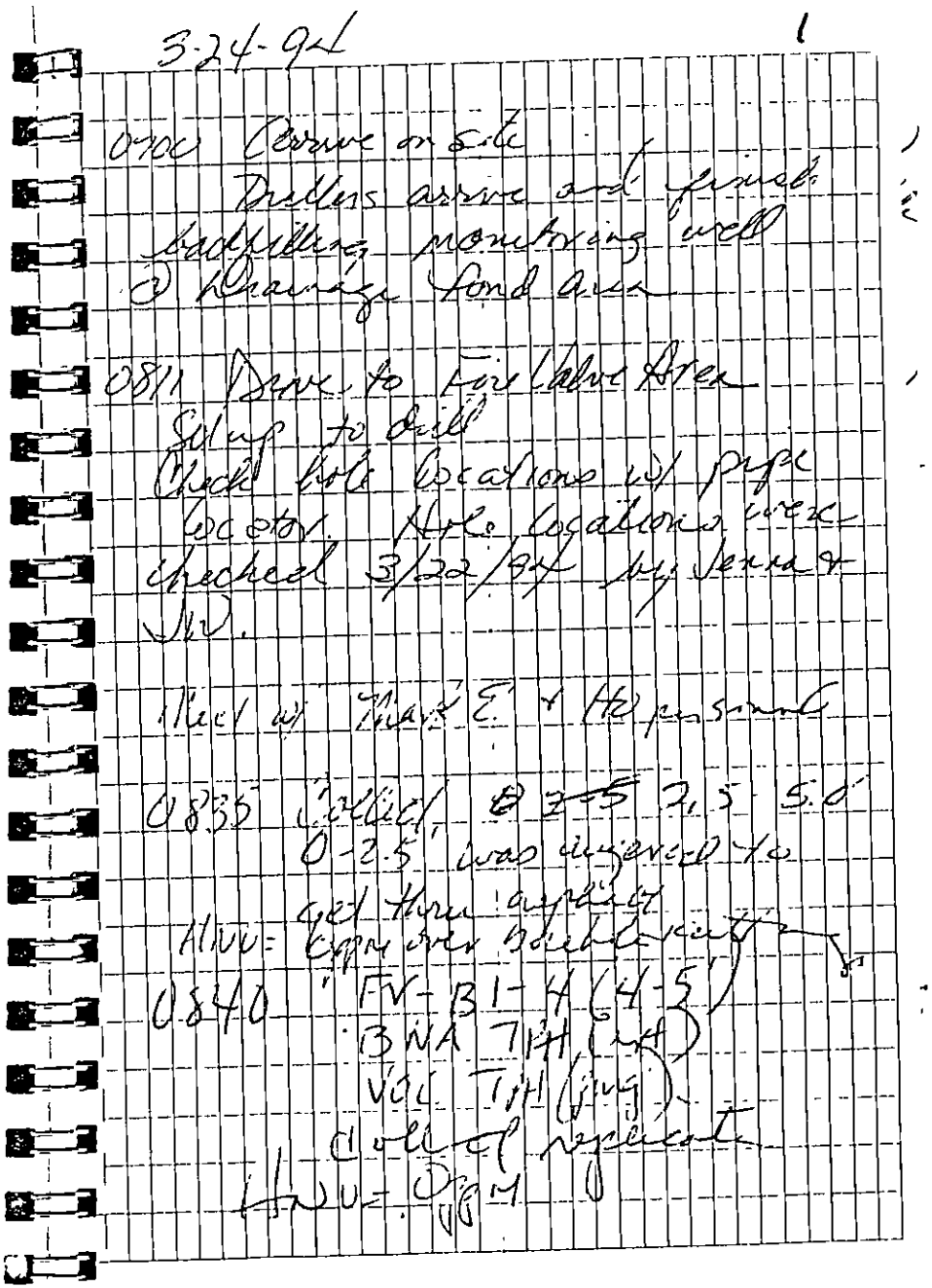
$\text{Tan } A = \frac{a}{b} = \text{Cot } B \qquad \text{Cosec } A = \frac{c}{a} = \text{Sec } B$

Given	Required	Solution
A, c	B, a, b	$B = 90° - A, a = C \sin A, b = C \cos A.$
A, b	B, a, c	$B = 90° - A, a = b \tan A, C = \frac{b}{\cos A}.$
A, a	B, b, c	$B = 90° - A, b = a \cot A, C = \frac{a}{\sin A}$
a, c	A, B, b	$\sin A = \frac{a}{c}, \cos B = \frac{a}{c}, b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	$\tan A = \frac{a}{b}, \cot B = \frac{a}{b}, c = \sqrt{a^2 + b^2}$

FORMULAE FOR SOLVING OBLIQUE TRIANGLES

Given	Required	Solution
A, a, b	B, c	$\sin B = \frac{b \sin A}{a}, c = \frac{a \sin C}{\sin A}$
A, B, a	b	$b = \frac{a \sin B}{\sin A}$
a, b, C	A, c	$A + B = 180° - C, C = \frac{a \sin C}{\sin A}$
a, b, c	Area	side $\frac{a+b+c}{2}$, area $= \sqrt{s(s-a)(s+b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

MADE IN U.S.A.



2 3-24-94

0900 Collect 5-10
2.5' recovery
9509- FV-B1-6.5 (6.5-7)
HNU = 0ppm collect replicate

Discuss soil boring locations w/ Mark Esch

0920 Collect 10-14' HNU=0ppm
14' auger refusal
9509- FV-B1-10 (10-11')

0930 Collect
9509- FV-B1B (13-14)
replicate

Talk to M. Esch about fence.
1000 [illegible] Contact
[illegible] discuss taking fence down w/ M Esch's direction
[illegible] called - we have her approval to replace or repair fence

HNU probe acting up [illegible] went to office to get other two lamps.

3-24-94 3

Talked to Rusty driller about the two of them taking down fence. They are not responsible for replacing fence - only taking down.

Rusty called his office and got the ok to take down fence

Crew set up on B-2
1025 Start drilling location close to asphalt.
FV-B2
0-2.5 [illegible]
9509 FV-B2-3.5 (3.5-4.5)
1040
HNU erratic readings lamp may be cold.

1055 FV-B2 5-10'
recov. 4.0'
HNU - 0 ppm
Collect FV-B2-5.7 (5.7-6.3)
BNA, CrH ext, VOCs (TPH, Pb[illegible]

110106

4 3-24-94

1120 [illegible] [illegible] [illegible] 4'
CMC Sampler [illegible] in the
auger. Difficulty in
retrieving sample --
Recover 3.0'
Sample 9529 FVB2-13
(13-14)

HNU = 0 ppm

B.O.H. = 14' auger refusal

1135 Crew to decon augers
GW + Mead to temp. office
Bring in samples. Contact
office

1300 Crew taking down fence

1335 Crew setup on FB FV-B3
1344 Calibrate HNU w/ different probe
1345 Sampling interval 1.5 to 5.0
Recover 2.5'
HNU = 3-13 ppm along core
2.3' = 13 ppm
2.7' = 7 ppm
3.3 = 6 ppm

5

3-24-94

1355 9569 FV B3 2 (2-3) dup
Strong jet fuel odor

1400 9529 FV B3 3 (3-4) rep
Strong odor

1425 9569 FVB3-6 (6-7)
Sl. diffraction on HNU @ 5.6
~~No~~ HNU = 0 ppm
VOC TPH (Purg) rep
BNA TPH (EXT)

1430 9569 FVB3 (9-10)
VOC TPH (Purg) rep
BNA TPH EXT

1450 9569 FVB3 - 10-15
10' recovd

9529 FVB3 10 (10-11)
VOC TPH Purg
BNA TPH EXT
Auger refusal 14.0'

6 3-24/94

1500 Start drilling B4

1515 9569. FV. B4-3 (3-4)
no HNU readings or HNU=0ppM
no odor
~~9569~~

1530 9569 FV.B4-5 (5-6)
HNU= 0ppM
sl. deflections - possibly
due to the rig instead of
sample

1535 9569.FV.B4-10-~~15~~ 14'
recover ~~2.5~~ 3.0'
HNU= 0ppM - over bkgd -
Bkgd = 1ppM (fumes of rig
& change in wind direction
no odor
Auger refusal 14.0'

1545 9569- FV.B4. 11 (11-12)

1550 9569-FV.B4 ~~13.5~~ 12.5 (12.5-13)

1600 Set up to grout holes

3-24-94 7

~~[illegible]~~ 20 bottles
- Call Duane Bofanc &
- confirmed samples.

- Shipped samples for lab.

- 1730 - left site JW

8 3-25-94

0700 Arrive onsite
0715 Drillers Onsite

0730 Set up on FSB-1. move fence - check line location

0810 4" auger to 3' -
Collect sample from bottom of auger 2.5-3
9569 FV. FSB-1- 2.5 (2.5-3)
BNA TPH VOCs HNU=0 ppm

0815 FSB1 4.5 (4.5-5)
BNA TPH VOCs HNU=0 ppm

~~0820~~ 0815 FSB1 - 7.5 (7.5-8)
BNA, TPH, VOCs
No odors HNU=0 ppm

Hole was placed in gravel of water line
BOH @ 8.0

0830 - Set up on FSB-2
0835 9569- FV- FSB-2 (2.5-3) HNU=0ppm
0840 9569- FV - FSB-2 (4.5-5) HNU=0ppm

3-25-94 9

0845 FV-FSB-2-7.5 (7.5-8)

0855 Set up on FSB3
locate along water line.

0900 Collect FV-FSB-3-2.5 (2.5-3)
notice odor - fuel. HNU-0ppm in hole. up + HNU=0ppm along auger

0910 Collect FV- FSB3-4.5 (4.5-5)
clear HNU-0ppm

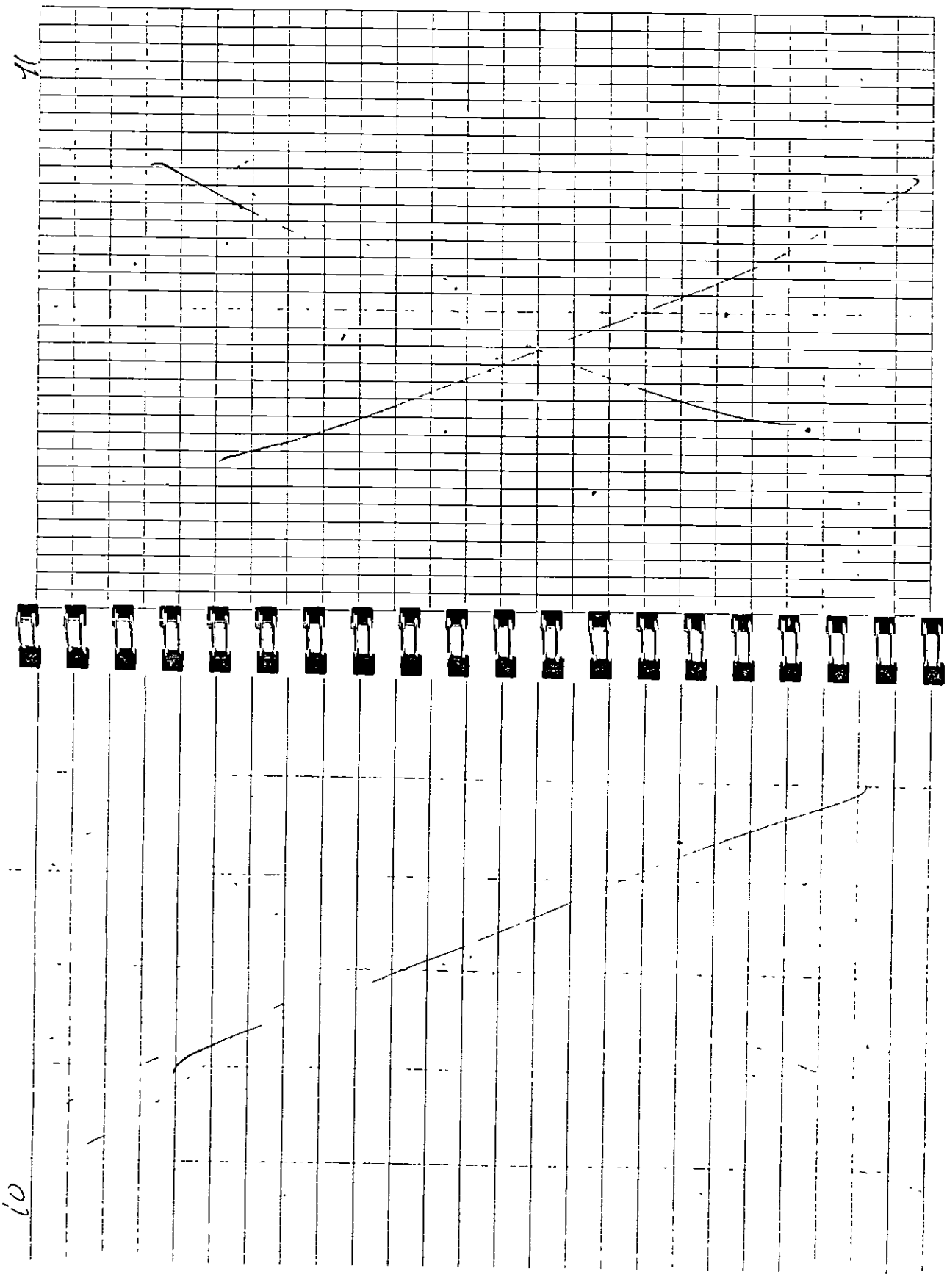
0915 Collect FV- FSB-3-7.5 (7.5-8)
encounter water in hole between 5 and 8 ft.

0930 Deliver samples to Pam.

0945 Set up over gas line across from FV-FSB-4
1005 Collect FV-FSB-4 2.5 (2.5-3)
HNU=0 ppm over hole and auger

1010 Collect FV- FSB-4-4.5 (4.5-5)
HNU=0 ppm over hole + auger

110199



1015 FV-FSB4-7.5 (7.5-8)
HNV = 0
no odor in hole or sample

1025 Set up on FSB-5
1030 FV-FSB5-2.5 (2.5-3)
HNV = 0 ppm over hole + auger

1035 FV-FSB5-4.5 (4.5-5)
HNV = 0 ppm over hole + auger

1045 FV-FSB5-7.5 (7.5-8)
HNV = 0 ppm
No odor detected

Crew needs to decon augers.

1230 Drove back to Fuel Valve Area. Crew taking lunch break. Augers + Sampling equipment decon'd.
Determined location of holes.
1310 Collect rinsate EB-1
1330 Setup on FSB-6

1330 FV-FSB-6-2.5 (2.5-3)
No HNV readings > 0 ppm

1335 FV-FSB-6-4.5 (4.5-5)
HNV = 0 ppm over hole + auger

Encounter water. Appears to be very close to gasline

1345 FV-FSB-6-7.5 (7.5-8)
HNV = 0 ppm

Move off hole to FSB-7

1400 Start drilling FSB-7 - adjacent to line that runs to fuel hydrants. Actual water line checked under overhead power line so could not drill in that location

1405 FV-FSB-7-2.5 (2.5-3)
HNV = 0 ppm over hole + auger

1410 FV-FSB-7-4.5 (4.5-5)
HNV = 0 ppm over hole + auger

110111

14 3-25-94

1420 FV-FSB7-2.5 (7.5-8.0)
HNU = 0 ppm

1430 Move off hole to FSB8

1430 FV-FSB-8-2.5 (2.5-3)
S. Odor

1435 FV-FSB-8-4.5 (4.5-5)

1445 FV-FSB8-7.5 (7.5-8)

1500 Stop drilling take samples to Pam

Call office - decide to have drillers backfill holes w/cement bent grout

Prep samples for lab. Call PACE - Ted arrange for late delivery. East side door - knock

dw Replicate 9569-FV-B5-3 (1300)
Original 9569-FV-B3-3 (1400)

Linman TNA 0830 Leigh S

3-25-94 15

Crew grouted holes left site

Pam continued to run analyses on all soil samples collected.

2015 Delivered samples to PACE lab for analyses.

[signature] 3/25/94

110112

FS-5 [illegible]

3/28/94

0710 Arrive onsite
0730 Call drillers to let them know we would be drilling borings and developing wells

Prep for field

0840 Drillers arrive onsite
0850 Safety Meeting

0900 Set up on FSB 9 [illegible] of water & gas line
0905 Collect 2.5-3.0'
FV-FSB 9-2.5
TPH, BNAs, VOCs
HNU=0 ppm over hole & auger
0910 Move hole location as at 4.0' depth hit something hard - Move 4.0' toward street
0915 Collect 4.5-5 from adjacent hole.
FV-FSB 9-4.5 (4.5-5)

3/28/94

0920 Collect FV-FSB 9-7.5-8.0
FV-FSB 7.5-8
Saturated clay [illegible]
HNU=0 ppm

0935 Set up on FSB 10
Drill to 3.0'
0940 Collect FV-FSB 10-2.5 (2.5-3)
HNU=0 ppm

0945 Drill to 5.0
Collect FV-FSB 10-4.5 (4.5-5)

0950 Drill to 8.0'
Collect FV-FSB 10-7.5 (7.5-8)
HNU=0 ppm

1000 Move to drill FSB 11
1005 Collect FV-FSB 11-2.5 (2.5-3)
HNU=0 ppm

[illegible] 1 ppm
[illegible]
1020 Collect FV-FSB 11-4.5 4.5-5
HNU=0 ppm

2-28-94

1030 FV-FSB11-7.5 (7.5-8')
HNu = 0 ppm - 1100 [illegible]

1035 FV-FSB11-9.5 (9.5-10)
HNu = 0 ppm

1045 Move to FSB 12

1050 Collect ~~a~~ 2.5-3.0'
FV-FSB12-2.5 (2.5-3)
HNu = 0 ppm

1100 Collect 4.5-5
FV-~~FSB~~-12-4.5 (4.5-5)
HNu = 0 ppm

1105 Collect 7.5-8
FV-FSB-12-7.5 (7.5-8)
HNu = 0 ppm

~~1110~~ 1115 Collect 9.5-10
FV. FSB 12-9.5 (9.5-10)
HNu = 0 ppm

Mark Esch stopped by @ 1045 - showed him boring locations completed at this time. Discussed Drainage Pond well - he said their copy of Work Plan didn't show a well. Told him to find report

2/28/94

dated January 1994.

1120 Decide to drill to 15.0' as we are at a higher elevation in relation to first several borings?

~~1125~~
1125 Collect 14.5-15'
FV-FSB12-14.5
HNu = 0 ppm over hole + augers
Bottom @ ~~15~~ 15.0'

1135 Crew off hole - decon augers - lunch break

1330 ~~1400~~ Move to location locate well [illegible]
Set up on FSB 13

1355 Collect FV-FSB13 2.5 (2.5-3.0) HNu = 0 ppm

1400 Collect FV FSB 13-4.5 (4.5 to 5.0) HNu 0 ppm

1405 Collect FV-FSB 13-7.5 (7.5 to 8) HNu = 0 ppm

110114

3/29/99

1415 Move to FSB14

1420 Collect 2.5'-3
FV-FSB14-2.5
HNu= 0ppm

1430 Collect 4.5-5
FV-FSB14-4.5
HNu = 0ppm

1435 Collect 7.5-8.0
FV-FSB14-7.5
HNu=0ppm BOH@8.0

1500 Set up on FSB-15

1505 Collect 2.5-3
FV-FSB 15-2.5
HNu=0ppm

1510 Collect 4.5-5
FV-FSB 15-4.5
HNu=0ppm

1515 Collect 7.5-8
FV-FSB 15-7.5
HNu=

3/29/99

1530 Move to Fire Valve Area

1540 Set up on FSB16
Collect FV-FSB16-2.5
odor
HNu in hole - 15 ppm
along auger - up to 13ppm

1555 ~~Stopped~~ Collect FSB16-4.5
(4.5-5.0)
HNu- >20 sample,
8-12 ppm in hole

1605 Collect 7.5 to 8.0
FSB16-7.5
HNu= up to 15ppm-erratic
No readings on soil
no odor
BOH @ 8.0

Stop drilling for day - Crew to clean up
new asphalt ...

1645 Called PACE to let them
know samples will be delivered
tomorrow.

1700 Drill crew left site

1700 [illegible] leave site

3/27/96

0705 arrive onsite

0730 [illegible] drillers w/ [illegible]

H&S meeting

Move fence for drilling FSB 17

0805 Collect 2.5-3

FV-FSB17-2.5

fuel odor HNU = 3 ppm over hole

2 ppm along auger

0810 Collect 4.5-5

FV-FSB17 4.5

fuel odor HNU = 3 ppm over hole

<2 ppm along auger

0815 Called 7.5-8

FV-FSB17 7.5

HNU = 65 ppm over hole

along auger = 0 ppm

No odor in soils at this depth BOH @ 8.0

wet to sat. soils on auger

Check FSB16 water @ 6.5' in hole

no [illegible] oil sheen

3/29/94

Meet w/ Mark E. tell him know about boring along water trench, remove fence

0850 Set up on FSB18
FV-FSB18-

0855 Collect 2.5-3
FV-FSB18-2.5
no fuel odor, HNU=0ppm

0905 Collect 4.5-5
FV-FSB18-4.5
no fuel odor HNU=0 ppm

0910 Collect 7.5-8
FV-FSB18 7.5
no fuel odor HNU

0920 Move off hole - Stop drilling
Deliver samples to PAV

Prep for drainage pond.

3/30/94

1352 Locate all borings and measure. Note some boring need addn grout

1525 Call office check on PLOT

1600 Continue locating hole + measuring

1700 Completed measurement.

Clean up empty jars and trash.

1850 leave site

Waste Sample for analyses was collected @ ~~1330~~ 1325

APPENDIX E

FIELD GC DATA

Portable Gas Chromatograph Head Space Screening Results for Fire Valve Area

Sample Number	Interval (feet)	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Unknowns (mV)
Boring Number 1						
FVB1-4	4-5	6.435	3.687	ND	ND	322.106
FVB1-6.5	6.5-7	28.59	4.298	ND	ND	313.607
FVB1-10	10-11	ND	3.02	ND	ND	235.61
FVB1-13	13-14	3.118	2.391	8.221	ND	246.044
Boring Number 2						
FVB2-3.5	3.5-4.5	ND	10.33	33.73	ND	277.863
FVB2-5.7	5.7-6.3	2.936	ND	ND	ND	118.758
FVB2-13	13-14	ND	1.148	ND	ND	215.483
Boring Number 3						
FVB3-2	2-3	ND	7864	2817	ND	107,348.37
FVB3-3	3-4	ND	16,620	93,840	ND	420,543.59
FVB3-6	6-7	201.7	98.96	ND	ND	2191.78
FVB3-9	9-10	2.16	1.962	ND	ND	233.979
FVB3-10	10-11	5.887	9.275	ND	ND	320.182
FVB3-10 Rp.	10-11	11.66	8.129	ND	ND	328.017
Boring Number 4						
FVB4-3	3-4	12.8	21.09	109.4	ND	1022.93
FVB4-5	5-6	32.76	5.68	118.5	ND	876.297
FVB4-11	11-12	ND	11.07	ND	ND	340.059
FVB4-11 Rp.	11-12	33.84	13.29	ND	ND	285.613
FVB4-12.5	12.5-13	2.143	1.608	ND	ND	225.396

Notes:
ND = Not Detected
Rp. = Replicate Analysis for Portable GC
Shading Indicates Sample Selected for Laboratory Analysis.

Portable Gas Chromatograph Head Space Screening Results for Fire Valve Area

Sample Number	Interval (feet)	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Unknowns (mV)
Field Screening Boring Number 1						
FV-FSB1-2.5	2.5-3	2.296	23	2.424	ND	634.904
FV-FSB1-4.5	4.5-5	7.397	11.28	1.617	ND	495.822
FV-FSB1-7.5	7.5-8	13.09	98.36	6.519	ND	1930.36
Field Screening Boring Number 2						
FV-FSB2-2.5	2.5-3	ND	1.009	ND	ND	240.04
FV-FSB2-4.5	4.5-5	ND	7.65	5.753	ND	282.002
FV-FSB2-7.5	7.5-8	4.82	11.58	ND	ND	393.892
Field Screening Boring Number 3						
FV-FSB3-2.5	2.5-3	36.35	148.9	224.8	ND	4404.98
FV-FSB3-4.5	4.5-5	72.96	116.7	259.4	ND	5232.98
FV-FSB3-7.5	7.5-8	11.77	8.917	29.51	ND	730.923
FV-FSB3-7.5 Rp.	7.5-8	11.86	8.251	33.12	ND	733.187
Field Screening Boring Number 4						
FV-FSB4-2.5	2.5-3	7.19	1.37	ND	ND	227.228
FV-FSB4-4.5	4.5-5	8.49	1.919	ND	ND	262.221
FV-FSB4-7.5	7.5-8	7.523	1.648	ND	ND	236.512
Field Screening Boring Number 5						
FV-FSB5-2.5	2.5-3	ND	1.114	ND	ND	270.699
FV-FSB5-4.5	4.5-5	ND	1.074	ND	ND	236.044
FV-FSB5-7.5	7.5-8	ND	1.207	ND	ND	212.689
Field Screening Boring Number 6						
FV-FSB6-2.5	2.5-3	ND	1.079	ND	ND	226.056
FV-FSB6-4.5	4.5-5	0.411	1.142	ND	ND	391.824
FV-FSB6-7.5	7.5-8	ND	16.58	ND	ND	391.605
FV-FSB6-7.5 Rp.	7 5-8	ND	1.702	ND	ND	327.212
Field Screening Boring Number 7						
FV-FSB7-2.5	2.5-3	9.711	1.623	ND	ND	260.334
FV-FSB7-4.5	4.5-5	0.368	1.106	ND	ND	321.835
FV-FSB7-7.5	7.5-8	ND	1.014	ND	ND	286
Field Screening Boring Number 8						
FV-FSB8-2.5	2.5-3	89.74	143.8	ND	ND	5961.488
FV-FSB8-4.5	4 5-5	8.253	10.14	16.38	ND	643.097
FV-FSB8-7.5	7.5-8	13.62	27.04	14.59	27.94	1193.15
Field Screening Boring Number 9						
FV-FSB9-2.5	2 5-3	3.741	1.829	ND	ND	206.625
FV-FSB9-4.5	4.5-5	ND	0.522	ND	ND	208.893
FV-FSB9-7.5	7 5-8	ND	9.64	98.95	ND	359.975

Notes:
ND = Not Detected Rp. = Replicate Analysis for Protable GC
Shading Indicates Sample Selected for laboratory Analysis

Portable Gas Chromatograph Head Space Screening Results for Fire Valve Area

Sample Number	Interval (feet)	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Xylenes (ug/l)	Unknowns (mV)
Field Screening Boring Number 10						
FV-FSB10-2.5	2.5-3	ND	0.849	ND	ND	186.732
FV-FSB10-4.5	4.5-5	ND	0.524	ND	ND	208.475
FV-FSB10-7.5	7.5-8	ND	1.062	ND	ND	219.622
FV-FSB10-7.5 Rp.	7.5-8	ND	ND	2.744	ND	242.079
Field Screening Boring Number 11						
FV-FSB11-2.5	2.5-3	ND	23.48	ND	ND	392.981
FV-FSB11-4.5	4.5-5	ND	0.645	ND	18.44	282.751
FV-FSB11-7.5	7.5-8	ND	1.069	ND	ND	333.792
FV-FSB11-9.5	9.5-10	ND	4.346	ND	ND	370.714
Field Screening Boring Number 12						
FV-FSB12-2.5	2.5-3	0.508	1.491	ND	ND	300.955
FV-FSB12-4.5	4.5-5	ND	0.957	ND	ND	225.996
FV-FSB12-7.5	7.5-8	ND	1.063	ND	ND	255.537
FV-FSB12-9.5	9.5-10	ND	1.033	1.481	ND	239.554
FV-FSB12-14.5	14.5-15	ND	1.009	72.04	ND	311.254
FV-FSB12-14.5 Rp.	14.5-15	ND	20.83	62.27	ND	297.374
Field Screening Boring Number 13						
FV-FSB13-2.5	2.5-3	0.74	0.649	ND	ND	210.552
FV-FSB13-4.5	4.5-5	0.901	1.152	ND	ND	255.89
FV-FSB13-7.5	7.5-8	1.253	ND	ND	ND	244.559
Field Screening Boring Number 14						
FV-FSB14-2.5	2.5-3	0.453	1.668	ND	ND	309.811
FV-FSB14-4.5	4.5-5	2.457	3.196	1.142	1.295	270.102
FV-FSB14-7.5	7.5-8	2.569	2.216	ND	ND	274.991
Field Screening Boring Number 15						
FV-FSB15-2.5	2 5-3	ND	0.455	ND	ND	213.739
FV-FSB15-4.5	4 5-5	6.572	4.504	ND	ND	346.993
FV-FSB15-7.5	7.5-8	ND	1.011	ND	ND	199.541
FV-FSB15-7.5 Rp.	7 5-8	13 35	5.91	2.33	ND	256.305
Field Screening Boring Number 16						
FV-FSB16-2.5	2.5-3	2969.0	6410.0	3927.0	ND	119,498.15
FV-FSB16-4.5	4.5-5	673.0	1428.0	1331.0	ND	32,363.65
FV-FSB16-7.5	7.5-8	21.48	95.67	197.4	ND	2451.96
Field Screening Boring Number 17						
FV-FSB17-2.5	2 5-3	ND	4172.0	5177.0	ND	118,208.17
FV-FSB17-4.5	4.5-5	166.2	411.2	624.2	ND	9,723.70
FV-FSB17-7.5	7 5-8	ND	ND	ND	ND	ND
Field Screening Boring Number 18						
FV-FSB18-2.5	2.5-3	2.155	1.533	5.557	ND	362.122
FV-FSB18-4.5	4.5-5	ND	ND	ND	ND	765.623
FV-FSB18-7.5	7.5-8	ND	ND	ND	ND	745.167

Notes: ND = Not Detected Rp. = Replicate Analysis for Protable GC
Shading Indicates Sample Selected for Laboratory Analysis.

110122

APPENDIX F

CHAIN-OF-CUSTODY FORMS

CHAIN OF CUSTODY RECORD

TETRA TECH, INC.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Date: 3-24-94
Page: 1 of
Project No: 9569
Shipment Method:
Number of Coolers Shipped: 1

Project Name: RC-AFB DRAINAGE POND
Project Manager: E. McKee
Sampler (Signature): Ali Westhoff

Sample Number	Date	Time	BNA, TPH (extract)	VOCs, TPH (purge)									Matrix Type	No. of Containers	Laboratory Comments
9569-DPW1-4 (4-4.5)	3/23/94	0900	1	1									S	2	
9569-DPW1-21 (21-22)	3/23/94	1020	1	1									S	2	
9569 DPW1-TR1	3/24/94	1455		1									W	2	
9569-FV-B1-13 (13-14)	3/24	0930	1	1									S	2	
9569-FVB1-13 (13-14) MS/MSD	3/24	0930	1	1									S	2	
9569-FVB2-13 (13-14)	3/24/94	1120	1	1									S	2	

Turn-around Time Requested:

Matrix: S = Soil M = Sediment W = Water A = Air
Preservatives: 1 = Ice 2 = HCl 3 = H2SO4 4 = NaOH 5 = HNO3

Relinquished By (Signature)	Received By (Signature)	Date	Time
Ali Westhoff	Jenna Read	3/24/94	05:25 pm
Jenna Read	[illegible]	3/24/94	1800

White = Return to Tetra Tech Yellow = Laboratory Pink = Tetra Tech

CHAIN OF CUSTODY RECORD

TETRA TECH, INC.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Date: 3-25-94
Page: 1 of [illegible]
Project No: 9569
Shipment Method: [illegible]
Number of Coolers Shipped: 1

Project Name: R6AFB: FIRE VALVE AREA
Project Manager: Julie W. Hull
Sampler: (Signature) [illegible] Westby

Sample Number	Date	Time	BNA/TPH (Extractable)	VOC/TPH (Purgeable)									Matrix Type	No. of Containers	Laboratory Comments
9569-FVB3-3(3.5)	3/24/94	1400	✓	✓									S	2	
9569-FVB3-10(10.5)	3/24/94	1450	✓	✓									S	2	
9569-FVB5-3(3.5)	3/25/94	1300	✓	✓									S	2	
9569-FVB4-3(3.5)	3/24/94	1515	✓	✓									S	2	
9569-FVB4-12.5(12.5)	3/24/94	1530	✓	✓									S	2	
9569-FVB1-5(5.5)	3/25/94	[illegible]	✓	✓									S	2	
~~[illegible]~~	~~3/25/94~~	~~0815~~											~~S~~	~~2~~	~~[illegible]~~
9569-FV-TB2	3/25/94	1620		✓									W	2	[illegible]
9569-FVTSB3-4.5(4.5)	3/23/94	0917	✓	✓									S	2	
9569-FVTSB3-9.5(9.5)	3/23/94	0945	✓	✓									S	2	
9569-FVTSB5-4.5(4.5)	3/23/94	1035	✓	✓									S	2	
9569-FV-TSB8-25(25.5)	3/23/94	1430	✓	✓									S	2	

Turn-around Time Requested:

Laboratory Comments:

Matrix: S = Soil M = Sediment W = Water A = Air
Preservatives: 1 = Ice 2 = HCl 3 = H2SO4 4 = NaOH 5 = HNO3

Relinquished By: (Signature)	Received By: (Signature)	Date:	Time:
[illegible] Westby	[illegible]	3/25/94	20:15

White = Return to Tetra Tech Yellow = Laboratory Pink = Tetra Tech

110124

CHAIN OF CUSTODY RECORD

TETRA TECH, INC.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Date: 3/25/94
Page: of
Project No: 9529
Shipment Method:
Number of Coolers Shipped:

110125

Project Name: RGAFB [illegible] Area			VOCs/TPH [illegible]	BNA/[illegible] EPA									Matrix Type	No. of Containers	Turn-around Time Requested:
Project Manager: [illegible]															
Sampler: (Signature) [illegible]															Laboratory Comments:
Sample Number:	Date:	Time:													
9529-FV-TB3	3/25/94	1025	X										W	2	[illegible]
9529 FV EB1	3/25/94	1310	X	X									W	8	[illegible]

Matrix: S = Soil M = Sediment W = Water A = Air
Preservatives: 1 = Ice 2 = HCl 3 = H2SO4 4 = NaOH 5 = HNO3

Relinquished By: (Signature)	Received By: (Signature)	Date:	Time:
[illegible]	[illegible]	3/25/94	20:15

White = Return to Tetra Tech Yellow = Laboratory Pink = Tetra Tech

CHAIN OF CUSTODY RECORD

TETRA TECH, INC.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Date: 3/30/94
Page: 1 of 1
Project No: 2509-01
Shipment Method: COURIER
Number of Coolers Shipped: 1

Project Name: RGAFB - FIRE VALVE AREA
Project Manager: JULIE WIETHOFF
Sampler: (Signature)

Sample Number:	Date:	Time:	Analyses (Preservative)									Matrix	No. of Containers	Turn-around Time Requested: / Laboratory Comments:
			BNAs	TPH EXT	VOCs									
EVESB18-2.5	3/29/94	0905	1	1								S	2	
EVESB17-2.5	3/29/94	0805	1									S	1	CONTINUATED
EVESB17-3.5	3/29/94	0810	1									S	1	
EVESB17-7.5	3/29/94	0815	1									S	1	
9SDA-TOC	3/29/94			1								W	1	RELEASE ANALYZE
														FOR BNA VOC AND
														TOTAL TPH EXT.
														ANALYZED

Matrix: S = Soil M = Sediment W = Water A = Air
Preservatives: 1 = Ice 2 = HCl 3 = H2SO4 4 = NaOH 5 = HNO3

Relinquished By: (Signature)	Received By: (Signature)	Date: 3/30/94	Time: 1225
Relinquished By: (Signature)	Received By: (Signature)	Date:	Time:
Relinquished By: (Signature)	Received By: (Signature)	Date:	Time:

110126 White = Return to Tetra Tech Yellow = Laboratory Pink = Tetra Tech

PACE INCORPORATED
THE ASSURANCE OF QUALITY

154355

CHAIN-OF-CUSTODY RECORD
Analytical Request

Client: TETRA TECH, INC.
Address: 10 E CAMBRIDGE CIR DR
KANSAS CITY, KS 66103
Phone: 913/621-6041

Report To: PAM McKEE TT
Bill To: KANSAS CITY OFFICE
P.O. # / Billing Reference: 9569-52
Project Name / No.: ~~DRAINAGE DATE~~ Fire Valve Area

Pace Client No.
Pace Project Manager
Pace Project No.
Requested Due Date:

Sampled By (PRINT): ROSS KROHN
Sampler Signature / Date Sampled: [illegible] 3/29/96

ITEM NO.	SAMPLE DESCRIPTION	TIME	MATRIX	PACE NO.	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	VOA	ANALYSES REQUEST	REMARKS
	[illegible]										
	[illegible]										
	9569 FV TBS	1405	W							2	

COOLER NOS.	BAILERS	SHIPMENT METHOD OUT / DATE	SHIPMENT METHOD RETURNED / DATE

ITEM NUMBER	RELINQUISHED BY / AFFILIATION	ACCEPTED BY / AFFILIATION	DATE	TIME
	[illegible]	[illegible]	[illegible]	[illegible]

Additional Comments

2

SEE REVERSE SIDE FOR INSTRUCTIONS

110127

APPENDIX G

ANALYTICAL DATA SUMMARY TABLES

Table 2.1
Analytical Data Summary
EPA Method 8015-Modified
Extractable Total Petroleum Hydrocarbons

Base. Richards-Gebaur AFB
Site: IRP Site SS009, Fire Valve Area
Extraction Method: EPA Method 3550
Analytical Method: EPA Method 8015-Modified
Matrix: Soil
Units: mg/kg

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	Extractable TPH Result	Extractable TPH Qualifiers/ Comments	Surrogate Recovery Di-n-octyl phthalate (36-158)	Surrogate Recovery Tetracosane (38-184)
Environmental Samples:								
FVB1-13	FV401	5	5	25	ND	U , g	96	106
FVB2-13	FV401	5	5	25	ND	U , g	103	110
FVB3-3	FV401	5	5	25	62	g	104	114
FVB3-10	FV401	5	5	25	ND	U , g	101	112
FVB4-3	FV401	5	5	25	ND	U , g	104	110
FVB4-12.5	FV401	5	5	25	ND	U , g	105	107
FVB5-3	FV401	5	5	25	12	g	102	114
FV-FSB1-7.5	FV401	5	5	25	35	g	110	114
FV-FSB3-4.5	FV401	5	5	25	370	g	108	115
FV-FSB3-7 5	FV401	5	5	25	9	g	94	104
FV-FSB5-4 5	FV401	5	5	25	ND	U , g	106	111
FV-FSB8-2 5	FV401	5	5	25	ND	U , g	103	112
Field Blank:								
Equipment Blank FV-EB1	FV401	400 µg/l	200 µg/l		ND		143 (21-161)	139 **
Lab Blank:								
BLANK 3-29-94	FV401	5	5		ND		107	109

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	Extractable TPH Result	Extractable TPH Qualifiers/ Comments	Surrogate Recovery Di-n-octyl phthalate (36-158)	Surrogate Recovery Tetracosane (38-184)
Environmental Samples:								
FV-FSB10-4 5	FV401	5	5	25	ND	U , g	114	111
FV-FSB14-7 5	FV401	5	5	25	ND	U , g	112	112
Field Blank:								
Equipment Blank FV-EB1	FV401	400 µg/l	200 µg/l		ND		143 (21-161)	139 **
Lab Blank:								
BLANK 4-6-94	FV401	5	5		ND		42	48

Table 2.1
Analytical Data Summary
EPA Method 8015-Modified
Extractable Total Petroleum Hydrocarbons

Base: Richards-Gebaur AFB
Site: IRP Site SS009, Fire Valve Area
Extraction Method. EPA Method 3550
Analytical Method. EPA Method 8015-Modified
Matrix: Soil
Units: mg/kg

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	Extractable TPH Result	Extractable TPH Qualifiers/ Comments	Surrogate Recovery Di-n-octyl phthalate (36-158)	Surrogate Recovery Tetracosane (38-184)
Environmental Samples:								
FV-FSB17-2 5	FV402	5	5	25	18	g	94	91
FV-FSB17-4 5	FV402	5	5	25	ND	U , g	95	118
FV-FSB17-7 5	FV402	5	5	25	ND	U , g	112	107
FV-FSB18-4.5	FV401	5	5	25	ND	U , g	94	124
Field Blank:								
Equipment Blank FV-EB1	FV401	400 µg/l	200 µg/l		ND		143 (21-161)	139 **
Lab Blank:								
BLANK 3-31-94	FV401	5	5		ND		110	118

NOTES. 1 * = PQL/MDL values were obtained from the PQL/MDL table provided by Pace Laboratories, Kansas.

2. ** = As stated in the QAPP, recovery limits for tetracosane in water samples have not yet been developed

3. The surrogate recovery limit values listed in the heading of each table refer to soil samples only Since the equipment blank sample is a water sample, the surrogate recovery limit values are listed next to the result for this sample.

4 MDNR = Missouri Department of Natural Resources

5 ND = Not Detected.

6 U = The analyte was analyzed for, but was not detected above the Method Detection Limit and was indicated with Not Detected (ND)

7. g = All data met prescribed criteria as detailed in the QAPP No qualifiers were used for data deemed acceptable

Table 2.2
Analytical Data Summary
EPA Method 8015-Modified
Purgeable Total Petroleum Hydrocarbons

Base Richards-Gebaur AFB
Site: IRP Site SS009, Fire Valve Area
Extraction Method EPA Method 5030
Analytical Method: EPA Method 8015-Modified
Matrix: Soil
Units: mg/kg

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FVB1-13	FV401	5	5	25	ND	U , g	103
FVB2-13	FV401	5	5	25	ND	U , g	113
Field Blank:							
Trip Blank							
TB-1	FV401	400 µg/l	200 µg/l		ND		103 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-1-94	FV401	5	5		ND		100

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FVB3-3	FV401	5	5	25	ND	U , g	117
FVB3-10	FV401	5	5	25	ND	U , g	99
Field Blank:							
Trip Blank							
TB-2	FV401	400 µg/l	200 µg/l		ND		113 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-1-94	FV401	5	5		ND		100

Table 2.2
Analytical Data Summary
EPA Method 8015-Modified
Purgeable Total Petroleum Hydrocarbons

Base: Richards-Gebaur AFB
Site: IRP Site SS009, Fire Valve Area
Extraction Method: EPA Method 5030
Analytical Method: EPA Method 8015-Modified
Matrix: Soil
Units: mg/kg

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FVB4-3	FV401	5	5	25	ND	U, g	99
FVB4-12 5	FV401	5	5	25	ND	U, g	110
FVB5-3	FV401	5	5	25	53	g	126
FV-FSB1-7 5	FV401	5	5	25	ND	U, g	107
FV-FSB3-4 5	FV401	5	5	25	ND	U, g	102
FV-FSB3-7.5	FV401	5	5	25	ND	U, g	102
FV-FSB5-4 5	FV401	5	5	25	ND	U, g	104
FV-FSB8-2.5	FV401	5	5	25	ND	U, g	106
Field Blank:							
Trip Blank							
TB-2	FV401	400 µg/l	200 µg/l		ND		113 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-2-94	FV401	5	5		ND		84

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FV-FSB10-4.5	FV401	5	5	25	ND	U, g	104
FV-FSB14-7 5	FV401	5	5	25	ND	U, g	104
Field Blank:							
Trip Blank							
TB-5	FV401	400 µg/l	200 µg/l		ND		108 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-2-94	FV401	5	5		ND		84

Table 2.2
Analytical Data Summary
EPA Method 8015-Modified
Purgeable Total Petroleum Hydrocarbons

Base: Richards-Gebaur AFB
Site: IRP Site SS009, Fire Valve Area
Extraction Method: EPA Method 5030
Analytical Method: EPA Method 8015-Modified
Matrix: Soil
Units mg/kg

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FV-FSB17-2.5	FV402	5	5	25	ND	U , g	123
FV-FSB17-4.5	FV402	5	5	25	ND	U , g	105
FV-FSB17-7.5	FV402	5	5	25	ND	U , g	108
Field Blank:							
Trip Blank							
TB-6	FV402	400 µg/l	200 µg/l		ND		99 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-4-94	FV402	5	5		ND		95

Sample ID #	Lab Batch #	PQL*	MDL*	MDNR Action Level	TPH-Gasoline Result	TPH-Gasoline Qualifiers/ Comments	Surrogate Recovery a,a,a-Trifluorotoluene (58-149)
Environmental Samples:							
FV-FSB18-4 5	FV401	5	5	25	ND	U , g	84
Field Blank:							
Trip Blank							
TB-6	FV402	400 µg/l	200 µg/l		ND		99 (59-115)
Equipment Blank							
FV-EB1	FV401	400 µg/l	200 µg/l		ND		109 (59-115)
Lab Blank:							
BLANK 4-2-94	FV401	5	5		ND		84

NOTES 1 * = PQL/MDL values were obtained from the PQL/MDL table provided by Pace Laboratories, Kansas

2. The surrogate recovery limit values listed in the heading of each table refer to soil samples only. The surrogate recovery limit values for water samples (i e. trip blanks and the equipment blank) are listed next to the result for each water sample.

110134

Table 2.2
Analytical Data Summary
EPA Method 8015-Modified
Purgeable Total Petroleum Hydrocarbons

Base: Richards-Gebaur AFB
Site. IRP Site SS009, Fire Valve Area
Extraction Method. EPA Method 5030
Analytical Method: EPA Method 8015-Modified
Matrix: Soil
Units: mg/kg

NOTES (cont'd): 3. MDNR = Missouri Department of Natural Resources.

4. ND = Not Detected.

5. U = The analyte was analyzed for, but was not detected above the Method Detection Limit and was indicated with Not Detected (ND).

6. g = All data met prescribed criteria as detailed in the QAPP. No qualifiers were used for data deemed acceptable.

Table 2 3
Analytical Data Summary
EPA Method 8240

Base Richards-Gebaur AFB
Site IRP Site SS009, (Fire Valve Area)
Extraction Method EPA Method 5030
Analytical Method EPA Method 8240
Matrix Soil
Units. mg/kg

				Environmental Samples				Field Blank		Lab Blank
				FVB1-13		FVB2-13		Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-1 FV401	FV-EB1 FV401	VBLK 21 FV401
Acetone	0 026	0.026	5600	ND	U, a	ND	U, a	ND	ND	0 048
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U, g	ND	U, g	ND	ND	ND
Chloroform	0 005	0 002	820	ND	U, g	ND	U, g	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U, g	ND	U, g	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U, g	ND	U, g	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U, g	ND	U, g	ND	ND	ND
Methylene chloride	0 005	0 004	670	0 009	Ba, J	ND	U, a	ND	ND	0 015
4-Methyl-2-pentanone	0 010	0 006	N/A	ND	U, a	ND	U, a	ND	ND	0 006
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U, g	ND	U, g	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U, a	ND	U, a	ND	ND	0,008
Surrogate Recovery.										
Toluene-d8 (77-140)				99	--	99	--	105 (80-122)	102 (80-122)	102
Bromofluorobenzene (62-121)				95	--	93	--	97 (70-124)	93 (70-124)	88
1,2-Dichloroethane d4 (70-133)				121	--	85	--	115 (71-128)	109 (71-128)	88

				Environmental Samples						Field Blank			Lab Blank
				FVB3-10		FVB4-3		FVB4-12 5		Trip	Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-2 FV401	TB-2 RE FV401	FV-EB1 FV401	VBLK 21 FV401
Acetone	0 026	0.026	5600	ND	U, a	ND	U, a	ND	U, a	ND	ND	ND	0 048
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
Chloroform	0 005	0.002	820	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
2-Hexanone	0.011	0 011	N/A	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
Methylene chloride	0 005	0 004	670	ND	U, a	ND	U, a	ND	U, a	ND	ND	ND	0 015
4-Methyl-2-pentanone	0 010	0 006	N/A	ND	U, a	ND	U, a	ND	U, a	ND	ND	ND	0 006
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U, g	ND	U, g	ND	U, g	ND	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U, a	ND	U, a	ND	U, a	ND	ND	ND	0.008
Surrogate Recovery.													
Toluene-d8 (77-140)				98	--	106	--	97	--	104 (80-122)	108 (80-122)	102 (80-122)	102
Bromofluorobenzene (62-121)				91	--	87	--	90	--	95 (70-124)	87 (70-124)	93 (70-124)	88
1,2-Dichloroethane-d4 (70-133)				81	--	83	--	81	--	150**(71-128)	103 (71-128)	109 (71-128)	88

Table 2.3
Analytical Data Summary
EPA Method 8240

Base Richards-Gebaur AFB
Site IRP Site SS009, (Fire Valve Area)
Extraction Method. EPA Method 5030
Analytical Method EPA Method 8240
Matrix Soil
Units mg/kg

				Environmental Samples						Field Blank			Lab Blank
				FVB3-3		FVB5-3		FV-FSB3-4 5		Trip	Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-2 FV401	TB-2 RE FV401	FV-EB1 FV401	VBLK 24 FV401
Acetone	0 026	0 026	5600	ND	U , a	ND	U , a	ND	U , a	ND	ND	ND	0 013
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U , g	ND	U , g	ND	U , g	ND	ND	ND	ND
Chloroform	0 005	0 002	820	0.011	g	ND	U , g	ND	U , g	ND	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	0 007	g	0 012	g	ND	U , g	ND	ND	ND	ND
Ethylbenzene	0 005	0 001	560	0 019	g	0 038	g	0 018	g	ND	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	0 029	g	0 010	Ba, J	0.009	Ba, J	ND	ND	ND	0 006
Methylene chloride	0 005	0 004	670	ND	U , a	ND	U , g	ND	U , g	ND	ND	ND	ND
4-Methyl-2-pentanone	0 010	0 006	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	0 006	J	ND	U , g	ND	U , g	ND	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U , g								
Surrogate Recovery.													
Toluene-d8 (77-140)				98	--	103	--	110	--	104 (80-122)	108 (80-122)	102 (80-122)	106
Bromofluorobenzene (62-121)				89	--	84	--	88	--	95 (70-124)	87 (70-124)	93 (70-124)	92
1,2-Dichloroethane d4 (70-133)				101	--	93	--	106	--	150**(71-128)	103 (71-128)	109 (71-128)	94

				Environmental Samples				Field Blank			Lab Blank
				FV-FSB1-7.5		FV-FSB3-7 5		Trip	Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-2 FV401	TB-2 RE FV401	FV-EB1 FV401	VBLK 22 FV401
Acetone	0 026	0 026	5600	ND	U , g	ND	U , g	ND	ND	ND	ND
Methyl Ethyl Ketone	0 026	0.026	1400	ND	U , a	ND	U , a	ND	ND	ND	0 008
Chloroform	0 005	0 002	820	ND	U , g	ND	U , g	ND	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U , g	ND	U , g	ND	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U , g	ND	U , g	ND	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U , g	ND	U , g	ND	ND	ND	ND
Methylene chloride	0 005	0 004	670	ND	U , g	ND	U , g	ND	ND	ND	ND
4-Methyl-2-pentanone	0 010	0 006	N/A	ND	U , g	ND	U , g	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U , g	ND	U , g	ND	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U , g	ND	U , g	ND	ND	ND	ND
Surrogate Recovery											
Toluene-d8 (77-140)				96	--	89	--	104 (80-122)	108 (80-122)	102 (80-122)	100
Bromofluorobenzene (62-121)				90	--	85	--	95 (70-124)	87 (70-124)	93 (70-124)	88
1,2-Dichloroethane d4 (70-133)				81	--	76	--	150**(71-128)	103 (71-128)	109 (71-128)	81

110136

Table 2.3
Analytical Data Summary
EPA Method 8240

Base Richards-Gebaur AFB
Site. IRP Site SS009, (Fire Valve Area)
Extraction Method EPA Method 5030
Analytical Method EPA Method 8240
Matrix. Soil
Units mg/kg

				Environmental Samples				Field Blank			Lab Blank
				FV-FSB5-4 5		FV-FS88-2 5		Trip	Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-2 FV401	TB-2 RE FV401	FV-EB1 FV401	VBLK 22 FV401
Acetone	0 026	0 026	560D	ND	U , g	ND	U , g	ND	ND	ND	ND
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U , a	ND	U , a	ND	ND	ND	0 008
Chloroform	0 005	0 002	820	ND	U , g	ND	U , g	ND	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U , g	ND	U , g	ND	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U , g	0 036	g	ND	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U , g	D 027	g	ND	ND	ND	ND
Methylene chloride	0 005	0 004	670	ND	U , g	ND	U , g	ND	ND	ND	ND
4-Methyl-2-pentanone	0 010	0 006	N/A	ND	U , g	ND	U , g	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U , g	ND	U , g	ND	ND	ND	ND
Xylenes (Total all isomers)	0 005	0.002	110000	ND	U , g	0 068	g	ND	ND	ND	ND
Surrogate Recovery*											
Toluene-d8 (77-140)				95	--	120	--	104 (80-122)	108 (80-122)	102 (80-122)	100
Bromofluorobenzene (62-121)				80	--	69	--	95 (70-124)	87 (70-124)	93 (70-124)	88
1,2-Dichloroethane-d4 (70-133)				76	--	77	--	150**(71-128)	103 (71-128)	109 (71-128)	81

				Environmental Samples				Field Blank		Lab Blank
				FV-FSB10-4 5		FV-FSB14-7 5		Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	TB-5 FV401	FV-EB1 FV401	VBLK 23 FV401
Acetone	0.026	0 026	5600	ND	U , g	ND	U , g	ND	ND	ND
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U , g	ND	U , g	ND	ND	ND
Chloroform	0 005	0 002	82D	ND	U , g	ND	U , g	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U , g	ND	U , g	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U , g	ND	U , g	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U , g	ND	U , g	ND	ND	ND
Methylene chloride	0 005	0 004	67D	ND	U , a	ND	U , a	ND	ND	0 0D7
4-Methyl-2-pentanone	0.010	0 006	N/A	ND	U , g	ND	U , g	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U , g	ND	U , g	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U , g	ND	U , g	ND	ND	ND
Surrogate Recovery:										
Toluene-d8 (77-140)				105	--	100	--	10D (80-122)	102 (80-122)	99
Bromofluorobenzene (62-121)				82	--	88	--	92 (70-124)	93 (70-124)	87
1,2-Dichloroethane d4 (70-133)				82	--	81	--	111 (71-128)	109 (71-128)	82

Table 2 3
Analytical Data Summary
EPA Method 8240

Base Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 5030
Analytical Method: EPA Method 8240
Matrix: Soil
Units: mg/kg

				Environmental Samples						Field Blank		Lab Blank
				FV-FSB17-2 5		FV-FSB17-4 5		FV-FSB17-7 5		Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV402 Result	Qualifiers/ Comments	FV402 Result	Qualifiers/ Comments	FV402 Result	Qualifiers/ Comments	TB-6 FV402	FV-EB1 FV401	V8LK 79 FV402
Acetone	0 026	0 026	5600	0 032	B , a	0 140	B , a	0 080	B , a	ND	ND	0 021
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U , g	N0	U , g	ND	U , g	ND	ND	ND
Chloroform	0 005	0 002	820	ND	U , g	ND	U , g	ND	U , g	ND	ND	ND
1,2-Dichloropropane	0 005	0 002	79	N0	U , g	ND	U , g	ND	U , g	ND	ND	ND
Ethylbenzene	0 005	0 001	560	ND	U , g	0 010	g	ND	U , g	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U , g	0 037	g	ND	U , g	ND	ND	ND
Methylene chloride	0 005	0 004	670	0 008	g	0 013	g	0 010	g	ND	ND	ND
4 Methyl-2-pentanone	0 010	0 006	N/A	ND	U , g	0 140	g	ND	U , g	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U , g	ND	U , g	ND	U , g	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U , g	0 045	g	ND	U , g	ND	ND	ND
Surrogate Recovery*												
Toluene-d8 (77-140)				100	--	106	--	105	--	103 (80-122)	102 (80-122)	99
Bromofluorobenzene (62-121)				99	--	104	--	103	--	94 (70-124)	93 (70-124)	93
1,2-Dichloroethane d4 (70-133)				115	--	120	--	118	--	111 (71-128)	109 (71-128)	108

				Environmental Sample		Field Blank		Lab Blank
				FV-FSB18-4 5		Trip	Equipment	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV402 Result	Qualifiers/ Comments	TB-6 FV402	FV-EB1 FV401	VBLK 24 FV402
Acetone	0 026	0 026	5600	ND	U , a	ND	N0	0.013
Methyl Ethyl Ketone	0 026	0 026	1400	ND	U , g	ND	N0	ND
Chloroform	0 005	0 002	820	ND	U , g	ND	N0	ND
1,2-Dichloropropane	0 005	0 002	79	ND	U , g	ND	ND	ND
Ethylbenzene	0 005	0 001	560	N0	U , g	ND	ND	ND
2-Hexanone	0 011	0 011	N/A	ND	U , g	ND	N0	ND
Methylene chloride	0 005	0 004	670	0 007	Ba, J	ND	ND	0 006
4-Methyl-2-pentanone	0 010	0 006	N/A	N0	U , g	ND	ND	ND
1,1,2,2-Tetrachloroethane	0 005	0 003	190	ND	U , g	ND	ND	ND
Xylenes (Total all isomers)	0 005	0 002	110000	ND	U , g	ND	ND	ND
Surrogate Recovery								
Toluene-d8 (77-140)				99	--	103 (80-122)	102 (80 122)	106
Bromofluorobenzene (62-121)				77	--	94 (70-124)	93 (70-124)	92
1,2-Dichloroethane-d4 (70-133)				85	--	111 (71-128)	109 (71-128)	94

110138

Table 2 3
Analytical Data Summary
EPA Method 8240

Base Richards-Gebaur AFB
Site· IRP Site SS009, (Fire Valve Area)
Extraction Method· EPA Method 5030
Analytical Method EPA Method 8240
Matrix Soil
Units mg/kg

NOTES 1 * = PQL/MDL values were obtained from the PQL/MDL table provided by Pace Laboratories, Kansas.

2. ** = Outside QC limits

3 The surrogate recovery limits listed in the first column of each table refer to soil samples only. The surrogate recovery limit values for water samples (i e. trip blanks and the equipment blank) are listed in parentheses next to the result for each water sample.

4. MDNR = Missouri Department of Natural Resources.

5 MDNR action levels obtained from 19CSR20-9 020, Proposed Rule, "Any-use Soil Levels for Residential Settings." Vol. 17, No 17, Sept. 1, 1992.

6 N/A = Not Available

7 ND = Not Detected.

8 B = The environmental sample result is less than five times or ten times (for common laboratory contaminants) the blank concentration. The useability of the data should be limited since this qualifier is not based on the instrument calibration (initial and continuing calibration verification and initial and continuing calibration blank) nor internal standard data review

J = The results are deemed qualified and the useability of the data is limited. J is also used when the analyte results are between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) For this qualification, no comment is included.

U = The analyte was analyzed for, but was not detected above the Method Detection Limit (MDL) and was indicated with Not Detected (ND)

9 a = Analyte was found in the method blank

g = All data met prescribed criteria as detailed in the QAPP. No qualifiers were used for data deemed acceptable.

10 The following analytes were included in the analysis of all samples; however, since the results for these analytes were Not Detected (ND) for all samples, these data were not included in this table.

ANALYTE	PQL (mg/kg)
Benzene	0 005
Bromodichloromethane	0.005
Bromoform	0.005
Bromomethane	0 010
Carbon disulfide	0 005
Carbon tetrachloride	0 005
Chlorobenzene	0 005
Chlorodibromomethane	0 005
Chloroethane	0 010
2-Chloroethyl vinyl ether	0 010
Chloromethane	0 029
1,1-Dichloroethane	0 005
1,2-Dichloroethane	0 005

ANALYTE	PQL (mg/kg)
1,1-Dichloroethene	0.005
cis-1,2-Dichloroethene	0.005
trans-1,2-Dichloroethene	0 005
cis-1,3-Dichloropropene	0 005
trans-1,3-Dichloropropene	0 005
Styrene	0 005
Tetrachloroethene	0 005
Toluene	0 005
1,1,1-Trichloroethane	0 005
1,1,2-Trichloroethane	0 005
Trichloroethene	0 005
Vinyl acetate	0 010
Vinyl chloride	0 010

110139

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method: EPA Method 8270
Matrix: Soil
Units: mg/kg

				Environmental Samples				Field Blank	Lab Blank
				FVB1-13		FVB2-13		Equipment	BLANK
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV-EB1 FV401	3/25/94 FV401
Acenaphthene	0 3	0.2	N/A	ND	U , g	ND	U , g	ND	ND
Anthracene	0 3	0.2	17000	ND	U , g	ND	U , g	ND	ND
2,6-Dinitrotoluene	0 3	0.2	7.4	ND	U , g	ND	U , g	ND	ND
Fluorene	0.3	0 2	2300	ND	U , g	ND	U , g	ND	ND
2-Methylnaphthalene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	ND
Naphthalene	0.3	0 3	230	ND	U , g	ND	U , g	ND	ND
N-Nitrosodiphenylamine	0.3	0.3	N/A	ND	U , g	ND	U , g	ND	ND
Phenanthrene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	ND
Phenol	0.3	0 3	34000	ND	U , g	ND	U , g	ND	ND
Surrogate Recovery:									
Nitrobenzene-d5 (13-107)				69	--	68	--	47 (27-101)	68
2-Fluorobiphenyl (3-100)				74	--	73	--	51 (13-110)	76
Terphenyl-d14 (14-202)				138	--	131	--	81 (38-122)	139
Phenol-d5 (6-153)				62	--	64	--	49 (10-152)	69
2-Fluorophenol (23-114)				69	--	73	--	48 (24-112)	81
2,4,6-Tribromophenol (26-135)				87	--	91	--	82 (30-149)	114
2-Chlorophenol-d4 (20-130)				63	--	67	--	41**	72
1,2-Dichlorobenzene-d4 (20-130)				69	--	65	--	41**	68

11140

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method. EPA Method 3550
Analytical Method: EPA Method 8270
Matrix: Soil
Units: mg/kg

				Environmental Samples								Field Blank	Lab Blank
				FVB3-3		FVB3-10		FVB4-3		FVB4-12.5		Equipment	BLANK
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV-EB1 FV401	3/29/94 FV401
Acenaphthene	0.3	0.2	N/A	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Anthracene	0.3	0.2	17000	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
2,6-Dinitrotoluene	0 3	0 2	7.4	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Fluorene	0.3	0.2	2300	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
2-Methylnaphthalene	0.3	0.2	N/A	0.79	g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Naphthalene	0 3	0.3	230	0.31	J	ND	U, g	ND	U, g	ND	U, g	ND	ND
N-Nitrosodiphenylamine	0 3	0 3	N/A	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Phenanthrene	0 3	0.2	N/A	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Phenol	0.3	0.3	34000	ND	U, g	ND	U, g	ND	U, g	ND	U, g	ND	ND
Surrogate Recovery.													
Nitrobenzene-d5 (13-107)				79	--	72	--	65	--	67	--	47 (27-101)	75
2-Fluorobiphenyl (3-100)				81	--	76	--	71	--	72	--	51 (13-110)	80
Terphenyl-d14 (14-202)				128	--	125	--	134	--	119	--	81 (38-122)	130
Phenol-d5 (6-153)				71	--	67	--	60	--	60	--	49 (10-152)	71
2-Fluorophenol (23-114)				82	--	77	--	71	--	66	--	48 (24-112)	85
2,4,6-Tribromophenol (26-135)				105	--	103	--	102	--	82	--	82 (30-149)	117
2-Chlorophenol-d4 (20-130)				72	--	68	--	61	--	60	--	41**	74
1,2-Dichlorobenzene-d4 (20-130)				77	--	72	--	66	--	67	--	41**	81

110141

Table 2.4
Analytical Data Summary
EPA Method 8270

Base. Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method: EPA Method 8270
Matrix: Soil
Units: mg/kg

				Environmental Samples								Field Blank	Lab Blank
				FVB5-3		FV-FSB1-7.5		FV-FSB3-4.5		FV-FSB3-7.5		Equipment	BLANK
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV-EB1 FV401	3/29/94 FV401
Acenaphthene	0.3	0.2	N/A	ND	U , g	ND	U , g	0.20	J	ND	U , g	ND	ND
Anthracene	0 3	0.2	17000	ND	U , g	ND	U , g	0.23	J	ND	U , g	ND	ND
2,6-Dinitrotoluene	0.3	0.2	7.4	ND	U , g	ND	U , g	0.34	J	ND	U , g	ND	ND
Fluorene	0.3	0 2	2300	ND	U , g	ND	U , g	0.36	J	ND	U , g	ND	ND
2-Methylnaphthalene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	U , g	ND	ND
Naphthalene	0.3	0 3	230	ND	U , g	ND	U , g	ND	U , g	ND	U , g	ND	ND
N-Nitrosodiphenylamine	0 3	0 3	N/A	ND	U , g	ND	U , g	0.61	g	ND	U , g	ND	ND
Phenanthrene	0.3	0.2	N/A	ND	U , g	ND	U , g	0.68	g	ND	U , g	ND	ND
Phenol	0 3	0 3	34000	ND	U , g	ND	U , g	ND	U , g	ND	U , g	ND	ND
Surrogate Recovery:													
Nitrobenzene-d5 (13-107)				59	--	69	--	78	--	64	--	47 (27-101)	75
2-Fluorobiphenyl (3-100)				63	--	80	--	84	--	63	--	51 (13-110)	80
Terphenyl-d14 (14-202)				113	--	121	--	117	--	121	--	81 (38-122)	130
Phenol-d5 (6-153)				54	--	67	--	70	--	60	--	49 (10-152)	71
2-Fluorophenol (23-114)				60	--	73	--	79	--	69	--	48 (24-112)	85
2,4,6-Tribromophenol (26-135)				99	--	112	--	121	--	96	--	82 (30-149)	117
2-Chlorophenol-d4 (20-130)				54	--	67	--	71	--	61	--	41**	74
1,2-Dichlorobenzene-d4 (20-130)				63	--	70	--	75	--	63	--	41**	81

1101142

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method: EPA Method 8270
Matrix: Soil
Units: mg/kg

				Environmental Samples				Field Blank	Lab Blank
				FV-FSB5-4.5		FV-FSB8-2 5		Equipment	BLANK
Parameters	PQL*	MDL*	MDNR Action Level	FV401 Result	Qualifiers/ Comments	FV401 Result	Qualifiers/ Comments	FV-EB1 FV401	3/29/94 FV401
Acenaphthene	0.3	0 2	N/A	ND	U , g	ND	U , g	ND	ND
Anthracene	0 3	0.2	17000	ND	U , g	ND	U , g	ND	ND
2,6-Dinitrotoluene	0.3	0.2	7.4	ND	U , g	ND	U , g	ND	ND
Fluorene	0.3	0.2	2300	ND	U , g	ND	U , g	ND	ND
2-Methylnaphthalene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	ND
Naphthalene	0.3	0 3	230	ND	U , g	ND	U , g	ND	ND
N-Nitrosodiphenylamine	0.3	0.3	N/A	ND	U , g	ND	U , g	ND	ND
Phenanthrene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	ND
Phenol	0.3	0 3	34000	ND	U , g	ND	U , g	ND	ND
Surrogate Recovery:									
Nitrobenzene-d5 (13-107)				65	--	74	--	47 (27-101)	75
2-Fluorobiphenyl (3-100)				72	--	86	--	51 (13-110)	80
Terphenyl-d14 (14-202)				134	--	128	--	81 (38-122)	130
Phenol-d5 (6-153)				62	--	66	--	49 (10-152)	71
2-Fluorophenol (23-114)				71	--	80	--	48 (24-112)	85
2,4,6-Tribromophenol (26-135)				112	--	106	--	82 (30-149)	117
2-Chlorophenol-d4 (20-130)				63	--	66	--	41**	74
1,2-Dichlorobenzene-d4 (20-130)				68	--	66	--	41**	81

110143

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method. EPA Method 8270
Matrix Soil
Units mg/kg

				Environmental Samples						Field Blank	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV-FSB10-4.5 FV401 Result	Qualifiers/ Comments	FV-FSB14-7.5 FV401 Result	Qualifiers/ Comments	FV-FSB18-4.5 FV401 Result	Qualifiers/ Comments	Equipment FV-EB1 FV401	BLANK 4/1/94 FV401
Acenaphthene	0 3	0 2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Anthracene	0.3	0 2	17000	ND	U , g	ND	U , g	ND	U , g	ND	ND
2,6-Dinitrotoluene	0.3	0.2	7.4	ND	U , g	ND	U , g	ND	U , g	ND	ND
Fluorene	0.3	0.2	2300	ND	U , g	ND	U , g	ND	U , g	ND	ND
2-Methylnaphthalene	0.3	0 2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Naphthalene	0.3	0.3	230	ND	U , g	ND	U , g	ND	U , g	ND	ND
N-Nitrosodiphenylamine	0.3	0.3	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Phenanthrene	0.3	0 2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Phenol	0.3	0.3	34000	ND	U , a	ND	U , a	ND	U , a	ND	0.02
Surrogate Recovery:											
Nitrobenzene-d5 (13-107)				75	--	67	--	69	--	47 (27-101)	71
2-Fluorobiphenyl (3-100)				83	--	73	--	78	--	51 (13-110)	73
Terphenyl-d14 (14-202)				102	--	96	--	98	--	81 (38-122)	123
Phenol-d5 (6-153)				63	--	61	--	62	--	49 (10-152)	63
2-Fluorophenol (23-114)				71	--	71	--	75	--	48 (24-112)	76
2,4,6-Tribromophenol (26-135)				89	--	88	--	111	--	82 (30-149)	87
2-Chlorophenol-d4 (20-130)				64	--	61	--	65	--	41**	62
1,2-Dichlorobenzene-d4 (20-130)				75	--	66	--	69	--	41**	66

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method. EPA Method 8270
Matrix Soil
Units: mg/kg

				Environmental Samples						Field Blank	Lab Blank
Parameters	PQL*	MDL*	MDNR Action Level	FV-FSB17-2.5 FV402 Result	FV-FSB17-2.5 Qualifiers/ Comments	FV-FSB17-4.5 FV402 Result	FV-FSB17-4.5 Qualifiers/ Comments	FV-FSB17-7.5 FV402 Result	FV-FSB17-7.5 Qualifiers/ Comments	Equipment FV-EB1 FV401	BLANK 4/1/94 FV401
Acenaphthene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Anthracene	0.3	0.2	17000	ND	U , g	ND	U , g	ND	U , g	ND	ND
2,6-Dinitrotoluene	0 3	0 2	7 4	ND	U , g	ND	U , g	ND	U , g	ND	ND
Fluorene	0.3	0.2	2300	ND	U , g	ND	U , g	ND	U , g	ND	ND
2-Methylnaphthalene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Naphthalene	0.3	0.3	230	ND	U , g	ND	U , g	ND	U , g	ND	ND
N-Nitrosodiphenylamine	0.3	0.3	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Phenanthrene	0.3	0.2	N/A	ND	U , g	ND	U , g	ND	U , g	ND	ND
Phenol	0.3	0 3	34000	ND	U , a	ND	U , a	ND	U , a	ND	0 02
Surrogate Recovery:											
Nitrobenzene-d5 (13-107)				62	--	63	--	71	--	47 (27-101)	71
2-Fluorobiphenyl (3-100)				75	--	72	--	76	--	51 (13-110)	73
Terphenyl-d14 (14-202)				110	--	99	--	100	--	81 (38-122)	123
Phenol-d5 (6-153)				58	--	56	--	60	--	49 (10-152)	63
2-Fluorophenol (23-114)				67	--	66	--	69	--	48 (24-112)	76
2,4,6-Tribromophenol (26-135)				105	--	114	--	86	--	82 (30-149)	87
2-Chlorophenol-d4 (20-130)				not reported	--	not reported	--	not reported	--	41**	62
1,2-Dichlorobenzene-d4 (20-130)				not reported	--	not reported	--	not reported	--	41**	66

NOTES:

1. * = PQL/MDL values were obtained from the PQL/MDL table provided by Pace Laboratories, Kansas.
2. ** = Laboratory recovery limits for 2-Chlorophenol-d4 and 1,2-Dichlorobenzene-d4 have not been established for water samples.

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site. IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method. EPA Method 8270
Matrix. Soil
Units: mg/kg

NOTES (continued): 3. Although most soil samples were spiked with and had percent recovery data for eight surrogate spiking compounds, the QAPP required the reporting of only six surrogate compounds. The surrogate compounds that were not required for this project (but were inadvertently reported for all samples except FV-FSB17-2.5, FV-FSB17-4.5, and FV-FSB17-7 5) are 2-Chlorophenol-d4 and 1,2-Dichlorobenzene-d4.

4. The surrogate recovery limits listed in the first column of this table refer to soil samples only. Since the equipment blank sample is a water sample, the surrogate recovery limit values are listed next to the results for this sample.

5. MDNR = Missouri Department of Natural Resources.

6. MDNR action levels obtained from 19CSR20-9.020, Proposed Rule, "Any-use Soil Levels for Residential Settings." Vol. 17, No. 17, Sept. 1, 1992.

7. N/A = Not Available.

8. ND = Not Detected.

9. J = The results are deemed qualified and the useability of the data is limited. J is also used when the analyte results are between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL). For this qualification, no comment is included.
U = The analyte was analyzed for, but was not detected above the Method Detection Limit (MDL) and was indicated with Not Detected (ND).

10 a = Analyte was detected in the method blank.
g = All data met prescribed criteria as detailed in the QAPP. No qualifiers were used for data deemed acceptable.

11. The following analytes were included in the analysis of all samples; however, since the results for these analytes were Not Detected (ND) for all samples, these data were not included in this table.

ANALYTE	PQL (mg/kg)	ANALYTE	PQL (mg/kg)
Acenaphthylene	0.3	Fluoranthene	0 3
Benzo (a) anthracene	0.3	Hexachlorobenzene	0.3
Benzo (b) fluoranthene	0 3	Hexachlorobutadiene	0.3
Benzo (k) fluoranthene	0.3	Hexachlorocyclopentadiene	0.6
Benzo (g,h,i) perylene	0.3	Hexachloroethane	0.3

110146

Table 2.4
Analytical Data Summary
EPA Method 8270

Base: Richards-Gebaur AFB
Site: IRP Site SS009, (Fire Valve Area)
Extraction Method: EPA Method 3550
Analytical Method: EPA Method 8270
Matrix: Soil
Units: mg/kg

NOTES (continued):

ANALYTE	PQL (mg/kg)
Benzo (a) pyrene	0.3
Benzyl alcohol	0 3
bis (2-Chloroethoxy) methane	0.3
bis (2-Chloroisopropyl) ether	0 3
bis (2-Chloroethyl) ether	0.3
bis (2-Ethylhexyl) phthalate	0.3
4-Bromophenyl phenyl ether	0.3
Benzyl butyl phthalate	0.3
4-Chloroaniline	0 3
2-Chloronaphthalene	0.3
4-Chlorophenyl phenyl ether	0.3
Chrysene	0.3
Dibenzo (a,h) anthracene	0.3
Dibenzofuran	0.3
Di-n-butyl phthalate	0.3
1,2-Dichlorobenzene	0.3
1,3-Dichlorobenzene	0.3
1,4-Dichlorobenzene	0 3
3,3'-Dichlorobenzidine	0.3
Dimethyl phthalate	0.3
Diethyl phthalate	0.3
2,4-Dinitrotoluene	0.3
Di-n-octyl phthalate	0.3

ANALYTE	PQL (mg/kg)
Indeno (1,2,3-cd) pyrene	0.3
Isophorone	0.3
2-Nitroaniline	1.6
3-Nitroaniline	1.6
4-Nitroaniline	1.6
Nitrobenzene	0.3
N-Nitroso-di-n-propylamine	0.3
Pyrene	0.3
1,2,4-Trichlorobenzene	0.3
Benzoic acid	1.6
4-Chloro-3-methylphenol	0.3
2-Chlorophenol	0.3
2,4-Dichlorophenol	0.3
2,4-Dimethylphenol	0.3
2-Methyl-4,6-dinitrophenol	1.6
2,4-Dinitrophenol	1.6
2-Methylphenol (o-cresol)	0.3
4-Methylphenol (p-cresol)	0.3
2-Nitrophenol	0.3
4-Nitrophenol	1.6
Pentachlorophenol	1.0
2,4,5-Trichlorophenol	1.6
2,4,6-Trichlorophenol	0.3

APPENDIX H

INVESTIGATION DERIVED WASTE ANALYSES

10149

SPECIAL WASTE MANIFEST DISPOSAL TICKET

Profile # _____

Pure View Recycling and Disposal Facility
DISPOSAL SITE

A Waste Management Company

DATE: 5-20-94

TRANSPORTER: Waste Hauling

GENERATOR: Richards Gebaur AFB

GENERATORS SIGNATURE: D. Mark Dick 20 MAY 94
DATE

CONTRACTOR & SIGNATURE: _____

WASTE DESCRIPTION: soils (drill cuttings)

STATE AUTHORIZATION # 94-616 QUANTITY 3 yds

ACCEPTED BY: _____ TIME: _____

DRIVERS SIGNATURE: _____ DATE 5/20/94

TRUCK NO. 421

BOX NO. 2070

3 TONS/YARDS

WHITE - TRANSPORTER COPY/YELLOW - DISPOSAL SITE COPY/PINK - GENERATOR COPY/GOLD - CONTRACTOR COPY

Waste Management of Kansas City
A WMI Service Company
1220 S. Brookside
Independence, MO 64052
816/254-1470

479408

SERVICE TICKET AGREEMENT/NON-HAZARDOUS WASTES

ORDER NUMBER	SERVICE DATE
	5-20

TIME IN	TIME OUT
9:35	9:45

ROUTE ID	DISPOSAL ID	DISPOSAL TICKET
421	FJ	

SIGNATURE	COD AMOUNT
TH	

ACCOUNT NUMBER _____ SERVICE TYPE _____

CUSTOMER Tetra Tech

ADDRESS Richards Gebaur

ORD QTY	SERVICE DESCRIPTION	WASTE TYPE	BILL CODE	MEASURE	BILL QUANTITY	AMOUNT
1	10	SP				

2078

SERVICE ACCEPTED SUBJECT TO THE TERMS AND CONDITIONS ON THE REVERSE SIDE AND PAYMENT AGREED TO BE MADE IN ACCORDANCE WITH THE CONTRACTOR'S CURRENT RATE SCHEDULE.

CUSTOMER SIGNATURE D. Mark Dick

CONTRACTOR SIGNATURE _____

0035 K (10/90) WHITE - OFFICE YELLOW - CUSTOMER PINK - CONTROL

Printed on recycled paper.

MIDWEST REGION
GENERATOR'S WASTE PROFILE SHEET

110150

PLEASE PRINT IN INK OR TYPE

Waste Profile Sheet Code: FVL MW

Proposed Management Facility: Forest View Recycling & Disposal Facility

[redacted] form is to be used to comply with the requirements of a waste agreement.

[redacted]TRUCTIONS FOR COMPLETING THIS FORM ARE ATTACHED

Decision Expiration Date: / /

A. WASTE GENERATOR INFORMATION

1. [redacted]enerator Name: Richards-Gebaur AFB
2. SIC Code:
3. Facility Address (site of waste generation):
4. Generator City State: Grandview MO
5. Zip Postal Code: 64147
6. [redacted]tate ID #: 94-616
7. [redacted]echnical Contact: Mr. Mark Esch
8. Phone: (816) 348-2511

B. WASTE STREAM INFORMATION (See Instructions)

1. [redacted]ame of Waste: Drill Cuttings - Soil - Petroleum Product
2. [redacted]rocess Generating Waste: Cuttings generated during drilling operations - [illegible]
3. Amount Units: approximately 3 cubic yards
4. Type A ☒ Type B ☐
5. Special Handling Instructions/Supplemental Information: None

[redacted]

6. Incidental Waste Types and Amounts: NA

[redacted]

C. TRANSPORTATION INFORMATION

[redacted]ethod of Shipment: ☐ Bulk Liquid ☐ Bulk Sludge ☐ Bulk Solid ☒ Drum/Box ☐ Other

[redacted]upplemental Shipping Information: None

[redacted]

[redacted]HYSICAL CHARACTERISTICS OF WASTE (See Instructions) (Omit for Type B)

[redacted]olor	2. Does the waste have a strong incidental odor?	3. Physical State @ 70 F/21°C	4. Layers	5. Specific Gravity	6. Free Liquids
Soil	☒ No ☐ Yes if so describe:	☒ Solid ☐ Semi-Solid ☐ Liquid ☐ Powder ☐ Other	☐ Multi-layered ☐ Bi-layered ☒ Single Phased	NA Range: Soil	☐ Yes ☒ No Volume:

pH ☐ ≤2 ☐ >2-4 ☐ 4-7 ☐ 7 ☐ 7-10 ☐ 10-<12.5 ☐ ≥12.5 ☐ Range ☒ NA

Flash Point ☒ None ☐ <140°F/60°C ☐ 140-199°F/60-93°C ☐ ≥200°F/93°C ☐ Closed Cup ☒ Open Cup

[redacted]HEMICAL COMPOSITION (Omit for Type B)

	RANGE (MIN-MAX)
Refer to	- %
Chemical Analyses	- %
Attached	- %
	- %
	- %
	- %
	- %
	- %
	- %
Total	%

The total composition must be greater than or equal to 100% (.0001% = 1 ppm or 1 mg/l)

2. Does the waste contain any of the following? (provide concentration if known)

	NO	or	LESS THAN	or	ACTUAL
PCBs	☐		☐ < 50 ppm		____ ppm
Cyanides	☐		☐ < 50 ppm		____ ppm
Sulfides	☐		☐ < 50 ppm		____ ppm
Phenols	☐		☐ < 50 ppm		____ ppm

[redacted]

[redacted]

F. SAMPLING SOURCE (Omit for Type B) (e.g. Drum, Lagoon, Pit, Pond, Tank, Vat): Rolloff Box

G. REPRESENTATIVE SAMPLE CERTIFICATION (Omit for Type B)

1. Print Sampler's Name: Julie Westhoff   2. Sample Date: 3/30/94

3. Sampler's Title: Geologist

4. Sampler's Employer (if other than Generator): Terra Tech, Inc., Kansas City, KS

The sampler's signature certifies that any sample [illegible] is representative of the waste described above pursuant to 40 CFR 261.20 (c) or equivalent rules.

5. Sampler's Signature: Julie Westhoff

H. GENERATOR'S CERTIFICATION

By signing this profile sheet, the Generator certifies:

1. The waste is not a Hazardous Waste as defined by USEPA and/or state regulation.

2. The waste does not contain regulated radioactive materials or regulated concentrations of PCBs (Polychlorinated Biphenyls).

3. The waste does not contain regulated concentrations of the following pesticides and herbicides: Chlordane, Endrin, Heptachlor (and its epoxide), Lindane, Methoxychlor, Toxaphene, 2,4-D, or 2,4,5-TP (Silvex).

4. The waste does not contain halogenated compounds such as: tetrachloroethylene, trichloroethylene, methylene chloride, [illegible] trichloroethane, carbon tetrachloride, chloroform, ortho-dichlorobenzene, dichlorodifluoromethane, [illegible] 2-trichloro-1,2,2-trifluoroethane, trichlorofluoromethane, [illegible] trichloroethylene, and 1,2-dichloroethylene at greater than 1% (10,000ppm) total solvent concentration. This listing includes any combination of the above named halogenated compounds where the total concentration of the sum of the concentrations of the individual compounds exceeds 1% or 10,000 ppm on a weight to weight basis.

5. This sheet and the attachments contain true and accurate descriptions of the waste material. All relevant information regarding known or suspected hazards in the possession of the Generator has been disclosed.

6. The Generator has read and understands the Contractor's Definition of Special Waste included in Part B 5. of the attached instructions to [illegible]. All types and amounts of special wastes produced in incidental amounts have been identified in section B.6. of this form.

7. The analytical data presented herein or attached hereto were derived from testing a representative sample taken in accordance with 40 CFR 261.20(c) or equivalent rules.

8. If any changes occur in the character of the waste, the Generator shall notify the Contractor prior to providing [illegible] the Contractor.

9. Signature: [signature]   10. Title: BRAC ENVIRONMENTAL COORDINATOR

11. Name (Type or Print): ______   12. Date: 10 MAY 94

NOTE: Omit sections D., E., F., and G., for Type B waste.

Comments:

110151

FVL 110152

Forest View Recycling and Disposal Facility
4800 Kaw Drive
P. O. Box 11116
Kansas City, KS 66111
A Division of Waste Management of Kansas, Inc.

SERVICE AGREEMENT
NON-HAZARDOUS WASTE DISPOSAL

The above-named disposal facility and corporation are referred to herein as "Facility" and "Contractor," respectively.

CUSTOMER'S BILLING NAME
TETRA TECH, INC.

CUSTOMER'S BILLING ADDRESS - Petroleum Product
10 E. Cambridge Circle Drive Ste. 130

CITY, STATE/PROVINCE, ZIP/POSTAL CODE
Kansas City, Kansas 66103

CUSTOMER CONTACT
Julie Westoff

PHONE NUMBER
(913 621-6041

BANK REFERENCE	BANK CONTACT	PHONE NUMBER
N/A	N/A	( )

Credit may be extended to Customer after appropriate credit information, in a form acceptable to Contractor, has been presented to and reviewed by Contractor Contractor may, in its sole discretion, require a collateral deposit (in the form of cash, letter of credit or surety bond) acceptable to Contractor. It is the responsibility of the Customer to keep said collateral deposit current. Collateral deposits, where utilized, may be adjusted when there is an increase in disposal tonnage and/or rates. Collateral deficiencies must be corrected within 30 days of notice of required adjustment.

This is a legally binding contract, and Contractor agrees to provide and Customer agrees to accept the waste disposal services subject to the terms and conditions specified in this contract.

ESTIMATED MONTHLY AMOUNT OF WASTE FOR DISPOSAL:

_____
(Include units e g , cubic yards, pounds, kilograms)

SPECIAL INSTRUCTIONS:

_____

_____

_____

INCIDENTAL SPECIAL WASTE TYPES AND AMOUNTS:

_____

_____

_____

THE TERMS AND CONDITIONS ON REVERSE SIDE AND THE ATTACHED CONTRACTOR'S DEFINITION OF SPECIAL WASTE ARE PART OF THIS AGREEMENT.

CUSTOMER

Julie M Westhoff
Authorized Signature

Geologist
Title

CONTRACTOR

Cindy L. Walton
Representative

Special Waste Consultant
Title

May 4, 1994

CONTRACTOR'S DEFINITION OF SPECIAL WASTE

1. "Special Waste" means Type A or Type B Special Wastes as defined below.

2. "Type A Special Waste" means any **waste from a commercial or industrial activity** meeting any of the following descriptions:

   a. A waste from an industrial process.
   b. A waste from a pollution control process.
   c. A waste containing free liquids.
   d. Residue and debris from the cleanup of a spill of a chemical substance or commercial product or a waste listed in a.-c., or e.-g. of this definition.
   e. Contaminated residuals, or articles from the cleanup of a facility generating, storing, treating, recycling, or disposing of chemical substances, commercial products, or wastes listed in a.-d., f., or g. of this definition.
   f. Any waste which is non-hazardous as a result of treatment pursuant to Subtitle C of the Resource Conservation and Recovery Act (RCRA).
   g. Chemical-containing equipment removed from service, in which the chemical composition and concentration are unknown.

3. "Type B Special Waste" means any **waste from a commercial or industrial activity** meeting any of the following descriptions:

   a. **Friable asbestos waste from building demolition or cleaning;** wall board, wall or ceiling spray coverings, pipe insulation, etc. This does not include nonfriable asbestos unless it has been processed, handled, or used in such a way that asbestos fibers may be freely released. Asbestos-bearing industrial process waste is a "Type A Special Waste".

   b. **Commercial products or chemicals which are off-specification, outdated, unused, or banned.** Outdated or off-specification uncontaminated food or beverage products in original consumer containers are not included in this category, unless management of such containers is restricted by applicable regulations. Containers which once held commercial products or chemicals are included in this category unless an end has been removed (for containers larger than 25 gallons), and the container is empty as defined by RCRA, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), or other applicable regulations.

      RCRA considers a container to be empty when: all wastes have been removed that can be removed using the practices commonly employed to remove materials from the type of container (e.g., pouring, pumping or aspirating), and no more than 1 inch (2.54 centimeters) of residue remains on the bottom of the container or inner liner, or no more than 3% by weight of the total capacity of the container remains in the container or inner liner (for containers $\leq$ 110 gallons), or no more than 0.3% by weight of the total capacity of the container remains in the container or inner liner (for containers > 110 gallons). Containers which once held ACUTELY HAZARDOUS WASTES must be triple rinsed with an appropriate solvent or cleaned by an equivalent method. The pressure in cylinders of compressed gas and aerosol cans must be substantially equivalent to atmospheric pressure.

      Containers which once held pesticides regulated under FIFRA must be empty according to label instructions.

   c. **Untreated medical waste - Any waste capable of inducing infection due to contamination with infectious agents from bio-medical sources including but not limited to a hospital, medical clinic, nursing home, medical practitioner, mortuary, taxidermist, veterinarian, veterinary hospital, animal testing laboratory, or medical testing laboratory.** Sharps from these sources must be rendered harmless or placed in needle puncture-proof containers.

   d. **Treated medical waste - Any wastes from a bio-medical source including but not limited to a hospital, medical clinic, nursing home, medical practitioner, mortuary, taxidermist, veterinarian, veterinary hospital, animal testing laboratory, or medical testing laboratory which has been autoclaved or otherwise heat treated or sterilized so that it is no longer capable of inducing infection.** Any sharps from these sources must be rendered harmless or placed in needle puncture-proof containers. Residue from incineration of medical waste is a "Type A Special Waste".

   e. **Residue/sludges from septic tanks, food service grease traps, or washwaters and wastewaters from commercial laundries, laundromats, and car washes, unless these wastes are managed at commercial or public treatment works.**

   f. **Chemical-containing equipment removed from service, in which the chemical composition and concentration are known (e.g., acetylene tanks, cathode ray tubes, lab equipment, fluorescent light tubes, etc.).**

   g. **Waste produced from the demolition or dismantling of industrial process equipment or facilities contaminated with chemicals from the industrial process.** Chemicals or residues removed or drained from such equipment or facilities are "Type A Special Wastes".

   h. **Incinerator ash generated at a Resource Recovery Facility that burned only non-hazardous household, commercial, or industrial waste and qualifies for the hazardous waste exclusion in 40 CFR 261.4(b).** If the regulatory authority does not recognize the household hazardous waste exclusion, then the ash is a "Type A Special Waste".

110154

Forest View Recycling and Disposal Facility
4800 Kaw Drive
P.O. Box 11116
Kansas City, Kansas 66102-111
913/287-2711 • FAX: 913/287-2793

A Waste Management Company

TETRA TECH, INC.
JULIE WESTOFF
10 E. CAMBRIDGE CIRCLE DRIVE
STE. 130
KANSAS CITY KS 66103

INVOICE DATE: APRIL 11, 1994
INVOICE NUMBER: 3580
PAGE: ONE

PROJECT NUMBER: #0144

PURCHASE ORDER NUMBER:

TRINITY RECEIVED IN LAB 04/04/94

13587: 0144-9569-FV-DCI FIRE DRAIN VALVE

JOB SITE: RICHARD GAUBAUER AFB

SAMPLE TAKEN: 03/30/94, TRINITY

REPORT DATE	REPORT #	DESCRIPTION
4/21	13587	TCLP Volatiles TCLP Semi-Volatiles Paint Filter Test Open Cup Flashpoint

TOTAL FOR REPORT #13587 $637.65

110155

Trinity ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	TETRA-TECH-RGAFB	DATE SAMPLED	03/30/94
CUSTOMER #	4423	DATE RECEIVED	04/04/94
LAB ID	13587	DATE EXTRACTED	04/06/94
MATRIX	SOLID	DATE ANALYZED	04/06/94
SAMPLE ID	0144-9569-FV-DCI FIRE DRAIN VALVE	DATE REPORTED	04/11/94
		UNITS	mg/L

Analysis performed in accordance with USEPA Toxicity Characteristic Leaching Procedure Method 1311.

TCLP Volatiles
SW-846-8260

COMPOUND	D-CODE	RESULT	DL	ABOVE LIMIT	REGULATORY LIMIT mg/L
Benzene	D018	.119	0.100		0.5
Carbon Tetrachloride	D019	ND	0.100		0.5
Chlorobenzene	D021	.118	0.100		100
Chloroform	D022	ND	0.100		6.0
1,4 Dichlorobenzene	D027	ND	0.100		7.5
1,2 Dichloroethane	D028	ND	0.100		0.5
1,1 Dichloroethene	D029	ND	0.100		0.7
Methyl Ethyl Ketone	D035	ND	0.100		200
Tetrachloroethene	D039	ND	0.100		0.7
Trichloroethene	D040	.101	0.100		0.5
Vinyl Chloride	D043	ND	0.100		0.2

DL - Detection Limit (mg/L) ND - Not Detected
*Result is above the Regulatory Limit.

Surrogate Results	% Recoveries	Acceptable Limits
Toluene-d8	98%	88-110
Bromofluorobenzene	101%	86-115
1,2 Dichloroethane-d4	102%	76-114

James F. Goodsmc
Chemist
Trinity Environmental Laboratories

Psalms 18 2

Trinity
ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	TETRA-TECH-RGAFB	DATE SAMPLED	03/30/94
CUSTOMER #	4423	DATE RECEIVED	04/04/94
LAB ID	13587	DATE EXTRACTED	04/06/94
MATRIX	SOLID	DATE ANALYZED	04/06/94
SAMPLE ID	0144-9569-FV-DCI FIRE DRAIN VALVE	DATE REPORTED	04/11/94
		UNITS	mg/L

Analysis performed in accordance with USEPA Toxicity Characteristic Leaching Procedure Method 1311.

TCLP Volatiles
SW-846-8260

Spike Results	% Recoveries	Acceptable Limits	Spike Duplicate % Difference
1,1-Dichloroethene	85%	61-145	10.01%
Benzene	102%	76-127	9.84%
Trichloroethene	91%	71-120	10.01%
Chlorobenzene	94%	75-130	9.29%
Toluene	96%	76-125	9.59%

James F. Soodsma
Chemist
Trinity Environmental Laboratories

110157

Trinity
ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	FOREST VIEW RECYCLING & DISPOSAL	DATE SAMPLED	3/30/94
CUSTOMER #	4423	DATE RECEIVED	04/04/94
LAB ID	13587	DATE EXTRACTED	04/07/94
MATRIX	SOLID	DATE ANALYZED	04/07/94
SAMPLE ID	0144-9569-FV-DCI FIRE DRAIN VALVE	UNITS	mg/L

Analysis performed in accordance with USEPA Toxicity Characteristic Leaching Procedure Method 1311.

TCLP Semi-Volatiles
SW-846-8270

COMPOUND	D-CODE	RESULT	DL	ABOVE LIMIT	REGULATORY LIMIT mg/L
Cresols (total)	D023	ND	.035		200
2,4 Dinitrotoluene	D030	ND	.035		0.13
Hexachlorobenzene	D032	ND	.035		0 13
Hexachlorobutadiene	D033	ND	.035		0.50
Hexachloroethane	D034	ND	.035		3.00
Nitrobenzene	D036	ND	.035		2.00
Pentachlorophenol	D037	ND	.070		100
Pyridine	D038	ND	.035		0.50
2,4,5-Trichlorophenol	D041	ND	.035		400
2,4,6-Trichlorophenol	D042	ND	.035		2.00

DL - Detection Limit (mg/L) ND - Not Detected

Surrogate Results	% Recoveries		Acceptable Limits
Nitrobenzene-d5	62%		35-114
2-Fluorobiphenyl	53%		43-116
Phenol-d6	4%	*	10-110
2-Fluorophenol	6%	*	21-110
2,4,6-Tribromophenol	64%		10-123
p-Terphenyl-d14	79%		33-141

* Low recovery due to matrix interference. Verified by Laboratory Control Sample.

Jenna Dillon
Chemist
Trinity Environmental Laboratories

110158

Trinity
ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	FOREST VIEW RECYCLING & DISPOSAL	DATE SAMPLED	3/30/94
CUSTOMER #	4423	DATE RECEIVED	04/04/94
LAB ID	13587	DATE EXTRACTED	04/07/94
MATRIX	SOLID	DATE ANALYZED	04/07/94
SAMPLE ID	0144-9569-FV-DCI FIRE DRAIN VALVE	UNITS	mg/L

Analysis performed in accordance with USEPA Toxicity Characteristic Leaching Procedure Method 1311.

TCLP Semi-Volatiles
SW-846-8270

Spike Results	% Recoveries	Acceptable Limits	Spike Duplicate % Difference
Phenol	22%	12-110	41.89%
2-Chlorophenol	57%	27-123	16.65%
1,4-Dichlorobenzene	40%	36-97	11.74%
N-Nitrosodipropylamine	81%	41-116	7.41%
1,2,4-Trichlorobenzene	44%	39-98	15.63%
4-Chloro-3-Methylphenol	42%	23-97	10.67%
4-Nitrophenol	39%	10-80	4.75%
Acenapthene	58%	46-118	11.64%
2,4-Dinitrotoluene	75%	24-96	18.71%
Pentachlorophenol	119%	9-103	15.00%
Pyrene	111%	26-127	37.49%

Jennie Green
Chemist
Trinity Environmental Laboratories

110159

Trinity
ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	TETRA-TECH-RGAFB	DATE SAMPLED	03/30/94
CUSTOMER #	4423	DATE RECEIVED	04/04/94
LAB ID	13587	DATE REPORTED	04/06/94
MATRIX	SOLID		
SAMPLE ID	0144-9569-FV-DCI FIRE DRAIN VALVE		

Paint Filter Liquids Test
SW-846-9095

	RESULT	DATE ANALYZED
Free Flowing Liquids	Negative	04/06/94

Scott Popejoy
Chemist
Trinity Environmental Laboratories

110160

Trinity
ENVIRONMENTAL LABORATORIES

62 East First Street
Mound Valley, KS 67354
Phone: 316/328-3222
FAX: 316/328-2033

COMPANY	TETRA-TECH-RGAFB	DATE RECEIVED	04/04/94
CUSTOMER #	4423		
MATRIX	SOLID		
SAMPLE ID	0144-9569-FV-DCI Fire Drain Valve		
LAB ID	13587		

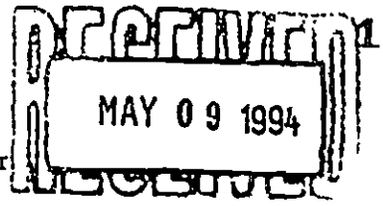
Open Cup Flashpoint
SW-846-1010 MOD

RESULT	DATE ANALYZED
NO FLASH OBSERVED < 140 F	04/07/94

Scott Pofahl
Chemist
Trinity Environmental Laboratories

State of Kansas

Joan Finney Governor



Department of Health and Environment

Robert Harder, Secretary

April 29, 1994

Julie Westoff
Tera-Tech, Inc.
10 E. Cambridge Circle Drive.
Suite 130
Kansas City, Kansas 66103

Re: Industrial Solid Waste Disposal Authorization Number 94-616

Dear Ms. Westoff:

We have considered your request for disposal of approximately 5 cubic yards of soil contaminated with jet fuel (analysis Provided). From spill clean-up, Richards - Gebaur AFB, Grandview, Mo. Approval is given to dispose of this waste at the Forest View landfill operating under Kansas Permit 469 provided the following conditions are met:

1. Approval to deliver the waste must be obtained from the landfill operator prior to transporting the waste to the landfill. The final decision on whether to accept or reject the waste rests with the landfill operator. Please contact Kevin O'Brien, General Manager, telephone 913-287-2711 to obtain approval. If the landfill operator refuses to accept this waste you should contact us to determine alternate disposal options.

2. The waste must be transported separately to the landfill and be identified to the operator upon delivery.

3. Kansas Administrative Regulation 28-29-23(r) requires solid waste disposal facilities to maintain a log of commercial or industrial wastes received such as sludges, liquids, and barreled waste. The log must indicate the source and quantity of waste and the disposal location thereof. The industrial waste authorization number should be used as identification when entering the shipment into the log.

vision of Environment, Bureau of Waste Management, Forbes Field Building 740, Topeka, Kansas 66620-0001

Telephone: (913) 296-160(
Fax Number: (913) 296-159:

4. This approval is valid for disposal of only one shipment to the landfill. If additional shipments are required you must contact us to receive another disposal authorization.

If you have any questions, feel free to contact me. (913-296-1596)

Sincerely yours,

Thomas Gross, Chief
Solid Waste Section
Bureau of Waste Management

d/rek/sc

C John Mitchell
Kevin O'Brien
John Cotter
Trevor Urban
Northeast District - Richard Bronaugh

APPENDIX I

QUALIFICATIONS OF KEY PERSONNEL

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Jenna Mead
Geologist

b. Project Assignment:
Project Geologist

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 3 With Other Firms 11

e. Education: Degree(s)/Year/Specialization:
B.S. 1976/Geology

f. Active Registration: Year First Registered/Discipline

g. Other Experience and Qualifications relevant to the Proposed Project:

Ms. Mead's geological experience is concentrated on sedimentary and organic geochemical processes. Her work experience includes groundwater monitoring well installation, well development, groundwater sampling, and soil sampling. She also has experience in subsurface mapping, data processing, computer modeling, hydrology, and environmental toxicology. Ms. Mead also has five years experience interpreting organic geochemical data for petroleum source-rock evaluation.

Experience relevant to the proposed project includes the following:

- Participated in the drilling, logging, development, and sampling of the groundwater monitoring wells at the Air Force Disposal Site Area at Stennis Space Center in Mississippi. Materials containing Agent Orange contaminated residuals were buried at this site. Co-authored the Site Investigation Report detailing the well installation activity and evaluating resultant groundwater sample data.

- The TES X Project Manager for the Westinghouse Plant Facility site in Bloomington, IN. This capacitor manufacturing plant has PCB contamination on site and at several NPL surrounding satellite sites. Responsibilities include review and oversight of sampling and removal actions conducted by the Westinghouse contractor.

- Site geologist for Tinker AFB, OK. Prepared the Project Management Plan, Project Schedule, and Data Management Plans, as well as large portions of the Sampling and Analyses Plan for the RFI on the Southwest Tanks Area at the Base. The soils in this area have been impacted by hydrocarbons and solvents previously stored in USTs.

- The TES X Project Manager for the Neal's Landfill NPL site in Monroe County, Indiana. PCB contaminated debris was buried in this former sinkhole. A dye tracer study was conducted to determine whether surrounding residential wells may have been contaminated by leachate from the landfill. Duties included coordinating various state and local agencies on the inventory of the wells and sample collection.

- The TES X Project Manager for an RFA on the 1,000 acre Armco, Inc. Midwestern Steel Division in Kansas City, MO. This RCRA facility had 32 SWMUs containing baghouse dust (heavy metals), acids, solvents, hydrocarbons, and PCBs, plus seven Areas of Concern.

- The TES X Project Manager for three subsites of the Hastings, NE Groundwater NPL site. Contamination is from organic solvents and pesticides. Project involved compiling groundwater data and supervising the creation of computer-generated (Auto CAD) maps and graphics to present these data.

- Collected water samples from residential wells and sludge samples from septic tanks for chemical analyses. Reviewed and compiled available documentation on previous sampling events. The purpose of this investigation was to identify all potential responsible parties for litigation concerning this southwest Missouri site.

- Project Manager for two sites in Missouri and Kansas involving the investigation of soils and groundwater impacted by leaking underground storage tanks.

- The TES X Project Manager for the Ortho-Chevron Chemical Division site in Maryland Heights, MO. Reviews and comments on the RP's contractor's plans, Risk Assessments, and other significant reports; conducts oversight of field activities.

- Participated in the drilling, logging, and development of the groundwater monitoring wells for the Kansas City Structural Steel site, a former smelter plant with lead and hydrocarbon contamination, located in Kansas City, KS. Authored the Groundwater Technical Memorandum, detailing the well installation activity and evaluating resultant groundwater sample data.

- Provided TES X oversight for the installation, slug testing, and sampling of groundwater wells by the Responsible Party's contractor during RFI activities at the Miles Laboratories, Inc. site in Elkhart, IN. This site is impacted by methylene chloride and ethyl alcohol denatured with acetone in soils and groundwater as the result of a release from an underground pipeline.

- Supervised underground storage tank excavations at a United States Post Office site in Walnut Creek, CA. Duties included collecting soil samples for hydrocarbons, interpreting data, and reporting to the site owner.

110164

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Julie M. WestHoff
Geologist

b. Project Assignment:
Community Relations/Site Geologist

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 6 With Other Firms 4

e. Education: Degree(s)/Year/Specialization

f. Active Registration: Year First Registered/Discipline

g. Other Experience and Qualifications Relevant to the Proposed Project:

Ms. WestHoff specializes in hazardous waste site investigations. Under U.S. EPA TES IX and X contracts, she has been involved in the preparation of ROD summaries for the U.S. EPA Region VI, provided technical support during PRP negotiations in U.S. EPA Region VII, prepared technical comments on RI/FS reports, and observed contractor remediation activities at Superfund sites. Ms. WestHoff has prepared Community Relations Plans for Superfund sites in U.S. EPA Regions III, VII, and IX. She has also been involved in the preparation of a groundwater contamination assessment study and has submitted recommendations for future investigations at Superfund sites. She has coordinated field activities and prepared portions of a SI Work Plan and Report for a former Air Force Disposal site. She has experience in site reconnaissance, geophysical surveys, monitoring well design and installation; and soil, groundwater, stream, and stream sediment sampling. She has provided technical assistance in the preparation of a Remedial Investigation/Feasibility Study (RI/FS) at a former DOE facility. She also has experience in contractor oversight work for RI/FS projects under the Defense Environmental Restoration Act (DERA).

Experience relevant to the proposed project includes the following:

- Prepared a draft and final Community Relations Plan for the Peoples Natural Gas site in Dubuque, IA. Activities included participating in public meetings, conducting community interviews, and preparing fact sheets and public notices.
- Prepared a Fact Sheet, as part of the State of California's Community Relations Program, describing various cleanup alternatives and proposed plan of action under evaluation by the California DTSC regarding the Mobile Smelting site.
- Under the ARCS contract for the U.S. EPA Region III, she prepared the draft Community Relations Plan for the North Road site in Jackson Township, PA.
- Managed the RI/FSs for two NPL sites that were former coal gasification plants. Responsibilities included: preparing the Statement of Facts for an Administrative Order on Consent; attending PRP negotiation meetings; assisting in PRP interviews; reviewing and evaluating site information; conducting site sampling visits; reviewing and commenting on PRP Removal and RI/FS Work Plans and reports; preparing technical memoranda outlining future field activities; and coordinating the in-house development of site specific groundwater and soil cleanup levels.
- Prepared a Community Relations Summary outlining future activities to be conducted at Tinker Air Force Base in Oklahoma City, OK. The purpose of the summary was to inform the public of the RFI to be completed at the Southwest Tank Area at the Air Force Base.
- Provided oversight for the RI/FS of a former Naval Ammunition Plant in Hastings, NE. DOD activities resulted in explosives and metals contamination of the soil and groundwater, as well as other hazardous substances. Responsibilities included oversight of soil borehole sampling, monitoring well installations, well development, and groundwater sampling.
- Under contract with Brooks AFB, prepared the PA/SI outline and Work Plan, which includes a Field Sampling Plan, QAPP, and Health and Safety Plan for the IRP Site SS009 at Richards-Gebaur AFB in Kansas City, MO. Future activities include site investigations to determine the source and extent of contamination.
- Participated in the Confirmation Study of a former Nebraska Ordnance Plant where DOD activities resulted in explosives and metals contamination of the soil and groundwater. Collected and prepared contaminated soil samples, stream water and sediment samples for transport to laboratories; installed and developed monitoring wells and completed the groundwater sampling program. Assisted in writing the preliminary report of the field procedures followed during the study.
- Coordinated field activities with field personnel and subcontractors at the Stennis Space Center in Mississippi. Assisted in the preparation of the SI Work Plan that further assessed the potential impact to shallow groundwater at this NASA facility by the disposal of solid wastes potentially contaminated with Agent Orange and dioxins on site. Authored portions of the SI report, detailing site activities and results of the investigation.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Pamela L. McKee
Environmental Scientist

b. Project Assignment:
Environmental Scientist

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 10 With Other Firms 2

e. Education: Degree(s)/Year/Specialization:
B.A. 1979/Biology

f. Active Registration: Year First Registered/Discipline

g. Other Experience and Qualifications relevant to the Proposed Project:

Ms. McKee is an environmental scientist with 12 years of professional experience primarily in hazardous waste management. She has participated as a member of both the U.S. EPA Region VII TAT and the TES IV and TES X contracts. Under the TAT contract, Ms. McKee provided technical support to the U.S. EPA for emergency response to oil and hazardous waste incidents, conducted site assessments, various types of sampling investigations, sample management, and provided oversight of removal activities, including cost tracking. Ms McKee has prepared and implemented sampling plans; health and safety plans, including acting as site safety officer; and quality assurance plans. Ms. McKee also has experience in analytical laboratory work in conjunction with wastewater treatment, and is a certified Asbestos Inspector.

Experience relevant to the proposed project includes the following.

- Serves as Task Manager for a Delivery Order with a value of $250,000 issued under the Brooks Air Force Base contract with the USAF at Richards-Gebaur AFB in Kansas City, MO. Tetra Tech is to provide environmental services for a PA/SI at IRP Site SS009, a CERCLA site, and an assessment of environmental conditions at a Drainage Pond, a RCRA site; she is responsible for the RCRA Assessment.

- Serves as manager to develop a comprehensive Preliminary Assessment report for a midwestern industrial manufacturing facility Information gathered during the initial efforts will be used to identify potential sources of TCE contamination, which has impacted nearby residential wells.

- Participated in intensive dioxin sampling efforts at numerous sites including the Minker/Stout/Romaine site, an NPL site Responsible for all aspects of field sample management, monitoring contractor cleanup and cost tracking at four dioxin immediate removal activities in Region VII for the U.S. EPA

- Participated in a focused RI/FS for a secondary smelting site in Mojave, CA, including on- and offsite sampling. Contamination includes elevated levels of lead and other metals, polynuclear aromatic hydrocarbons, and dioxin/furans. PCBs were allegedly burned as fuel in some operations.

- Conducted or participated in 9 RCRA Facility Assessments in a 3-state area Facilities included steel fabrication, assembly of appliances, an unpermitted landfill, and solvent recovery. Also included was a cement producer using blended hazardous waste fuel as a supplementary fuel source in rotary kilns.

- Conducted and coordinated the technical review, oversight of field investigations, and evaluation of corrective measures for four facilities in Nebraska and Indiana.

- Performed initial emergency response activities at a warehouse in St. Joseph, MO involving the release of ethylene dibromide from drums of canceled pesticide stored in the basement Activities included air monitoring during venting operations, sampling groundwater that had seeped into the basement and elevator shaft, and oversight of the Potentially Responsible Party's emergency response actions at a site receiving extensive media coverage.

- Prepared the immediate removal action memo for groundwater contamination at the North U Drive site, an NPL site, in Springfield, MO. Provided contractor oversight and participated in efforts to determine the source of groundwater contamination.

- Assisted in an intensive dioxin sampling effort at A.P. Hill, VA. Over 120 composite soil samples were collected during an 11-day period from the site of the National Boy Scout Jamboree.

- Drafted the sampling plan, health and safety plan, and quality assurance plan for soil sampling in an area of a DOE facility suspected of commingled waste contamination. Areas to be sampled were known to be radiologically contaminated.

- Coordinated and conducted soil sampling activities at the 27 acre Kansas City Structural Steel site contaminated with lead from smelting operations. Assisted in the selection of vendors to perform solidification/stabilization treatability studies. Performed research to determine how the Land Disposal Restrictions (RCRA) would affect this CERCLA site and provided alternatives for effective cleanup to the client.

- Conducted sampling of waste flammable liquids (paint wastes) at an abandoned drum site in Kansas City, MO. Approximately 100 drums were characterized and analyzed for priority pollutants.

- Conducted groundwater sampling at an Air Force disposal site at the Stennis Space Center in Mississippi for materials with residual Agent Orange contamination.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Randall J Overton
Principal Hydrogeologist

b. Project Assignment:
Project Manager

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 3 With Other Firms 17

e. Education: Degree(s)/Year/Specialization.
B S 1974/Forest Hydrology

f. Active Registration: Year First Registered/Discipline

g. Other Experience and Qualifications relevant to the Proposed Project:
Mr Overton is a hydrogeologist with 20 years of professional experience specializing in the hydrology and hydrogeochemistry of drastically disturbed sites with extensive involvement in groundwater monitoring and design of monitoring networks. His experience includes skills evaluating the interaction of groundwater with geologic materials, including the influence of site geochemistry on contaminant fate and transport His experience with complex groundwater systems has provided him the expertise to identify other influences on water quality problems, such as determining the relationships between periodic recharge events and variability in mobility of contaminants based on changes to system redox potential and leaching of nutrients. He has conducted numerous assessments of groundwater systems where recharge, evapotranspiration, groundwater flow, site geochemistry, and groundwater quality were considered. He has developed a number of unique remediation techniques to solve contamination problems, including the use of wetlands as a sink for metal contaminated groundwater discharges, manipulating groundwater flow to alter residence time to increase the amount of microbial removal of contaminants, and increasing site recharge to alter system redox potentials fixing metals in situ Mr. Overton's extensive experience also includes the remediation of hydrocarbon contaminated sites, focusing on in situ cleanups utilizing bioremediation and accelerated leaching techniques. Mr. Overton has also been retained as an expert witness providing litigation support

Experience relevant to the proposed project includes the following:

- Designed and implemented a groundwater treatment system on an emergency basis when chlorinated solvents appeared in a spring used to water livestock at a farm located downgradient of a manufacturing facility The source of the solvent was believed to be from a former waste storage area at the manufacturing facility. The contaminant plume was intercepted by installing a cutoff trench between the spring and the source area. Contaminated groundwater was treated through a portable airstripper and the treated effluent piped to a stream channel ensuring livestock a water supply while a full investigation was conducted, and a remedy determined

- Represented DOD in evaluating the RI/FS conducted for the site. Purpose of the work was to determine whether DOD's proposed takeover of operations and maintenance of the remediation system would be equitable. As a result of the review, DOD was able to demonstrate that the remedial design loaded most costs to O & M causing unfair distribution of costs As a result, DOD savings will exceed $1 Million.

- Represented USAF in evaluating $4.6 million RI/FS results for which the Air Force was expected to pay. The evaluation used the RI/FS data with supplemental groundwater transport and fate modeling to demonstrate that the Air Force could not be responsible for the levels of groundwater contamination affecting municipal wells As a result, the costs were reallocated among other parties

- Developed an insoluble sulfide treatment system for water contaminated with several hundred mg/ℓ of hexavalent chromium and lead. The process produced a final solidified sludge that passed TCLP. The system was designed to minimize generation of hydrogen sulfide gas and to be operated in a batch mode.

- Conducted/supervised over 100 site investigations for leaking underground storage tanks. Typical site investigations included phased drilling of boreholes, soil sampling, and installation of monitoring wells. Soil gas surveys were frequently used early in the investigation to optimize locations of soil borings and monitoring wells. Computer modeling of contaminant migration was also used to estimate the effectiveness of proposed remediation systems, as well as determining the probable maximum extent of contaminate migration Remedial designs include simple excavations, in situ bioremediation, soil venting, as well as pump and treat systems.

- Designed hydrologic controls for acid mine drainage problems for a number of abandoned mines in Kansas, Missouri, Iowa, and Colorado. Designs focused on using the hydrologic system and geochemical processes to control oxidation of metal sulfides causing the acid drainage problems In certain projects, wetlands were established to assist with polishing metals from groundwater discharging from reclaimed waste piles.

- Conducted an evaluation and groundwater assessment for a site in central Missouri where heavy metals contamination and hydrocarbons from different sources mixed in the groundwater system creating a unique condition where metals concentrations tended to vary as a function of groundwater redox potentials. The evaluation explored onsite solubility controls of metals in an effort to determine whether seasonally induced changes in redox potentials would significantly affect metals in solution

- Performed a major investigation of a gasoline contaminated aquifer utilized by a community of several hundred people. This complex project involved determining the sources of contamination. In addition to conventional investigation techniques, fingerprinting of the contamination was used to document the original sources of the contamination. The project also included development of alternate water supplies for a significant percentage of the community. In situ bioremediation of the contaminated aquifer is being investigated as the primary remediation process In addition, a Risk Assessment was prepared to determine the potential health risks associated with the contamination caused by the client, as compared with the contributions of other sources, some of which may have existed for over 20 years.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Russell B. Krohn
Associate Director, Environmental Scientist

b. Project Assignment:
Deputy Program Manager

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 11 With Other Firms 5

e. Education: Degree(s)/Year/Specialization
B.S. 1977/Biology, Earth Science
M.S. 1980/Biology

f. Active Registration: Year First Registered/Discipline

g. Other Experience and Qualifications Relevant to the Proposed Project:

Mr. Krohn is a specialist in hazardous waste management at Tetra Tech, with 16 years professional experience concentrated in environmental program management for site remediation, waste site investigations, emergency response, chemical health and safety, and response personnel training. He is experienced with site cleanup methods and operations as related to RCRA and CERCLA actions, and has been involved in over 100 waste site investigations and 40 spill responses including 22 sites on the National Priorities List and 12 proposed sites in 10 states He is the manager of the Kansas City, KS and Oklahoma City, OK offices, responsible for program and project management including development of RI/FS documents, quality assurance project plans, health and safety plans, project work plans, interim and final reports, and project cost estimates. He has served as Team Leader of the U.S. EPA Technical Assistance Team (TAT), directing professional staff in emergency response to hazardous material and oil spills, site investigations, immediate removal actions, response personnel training, and data review.

Experience relevant to the proposed project includes the following.

- Deputy Program Manager for a 5 year contract with the USAF (Air Logistics Center) with a potential estimated value of $32.5 million at Tinker Air Force Base in Oklahoma City, OK. The contract is to provide a wide range of environmental services including site investigations, feasibility and special studies, remedial design, and construction management. The first Delivery Order directs Tetra Tech to conduct a RCRA Facility Investigation for the Southwest Tanks Area. Tetra Tech will provide all services, management, and resources necessary to fully characterize the contaminant pathway and develop an RFI report.

- Serves as Project Manager for a Delivery Order with a value of $250,000 issued under the Brooks Air Force Base AFCEE contract Tetra Tech is to provide environmental services for a Preliminary Assessment/Site Investigation at IRP Site SS009, (CERCLA) and an assessment of environmental conditions at a Drainage Pond, a RCRA site

- Serves as Project Manager to conduct a comprehensive PA/SI and RI/FS for a midwestern industrial manufacturing facility. Information gathered during the initial efforts will be used to identify potential sources of TCE contamination; the RI/FS will be designed to assess those sources. As the hydrogeology is complex in the area due to mining and semi-karst conditions, dye tracer studies may be conducted to assess groundwater flow pathways, and contaminant fate and transport modeling will be performed. Litigation support activities are also conducted

- Manager of a two year, $3 million ceiling contract for the Fort Worth COE and the Air Force Regional Civil Engineers in Dallas, providing technical review and generation of new data for RI/FSs conducted at sites where the USAF has been named as a Potentially Responsible Party One site was the South Valley, NM NPL site, as well as the Hardage-Criner NPL site in OK.

- Manages the development and implementation of a Removal Action Work Plan for the remediation of this inactive smelter and steel fabrication facility in Kansas City, KS These actions were conducted under a U.S. EPA Consent Order and included the identification of ARARs, air monitoring activities, soil stabilization/solidification plans for lead, groundwater monitoring well installation, surface soil sampling and analyses, treatability studies, former leaking underground storage tanks remediation, drum waste characterization, health and safety, quality assurance, and oversight of construction activities for soil remediation.

- Managed the Midwest operations of the TES IV and X EPA contracts, directing over 150 work assignments in 3 EPA regions for 6 years with revenues up to $1 million per year. Projects included conducting site investigations, RCRA facility compliance inspections, providing oversight of Responsible Party waste site remedial efforts, assessment of environmental and human health risks, laboratory data validation, and groundwater monitoring system evaluations.

- Serves as Project Manager for a California Department of Toxic Substances Control task orders to provide technical support services and RI/FS for the Mobile Smelting Site near Mojave. The metals recovery facility has widespread metals, PAH, and dioxin/furan contamination. Specific tasks include a comprehensive file review and report; soil sampling of local residences and planning for removal of large volumes of scrap around the 11-acre property. An FS was developed to identify and screen potential treatment technologies that may be applied to the array of contaminants, including accumulations of baghouse dust and bottom ash.

- Managed the technical review and assessment of RI/FSs for the AFRCE concerning the Albuquerque, San Jose 6 well that is contaminated with solvents. This effort focused on identifying areas that are not adequately investigated and affect either the potential remedial design, or the assessment of relative responsibility for the USAF/GE Plant 83 facility and five other identified PRP facilities in the area.

- Managed a PA/SI at the Stennis Space Center NASA facility for the AFRCE to assess the potential impact to shallow groundwater by the 1970s disposal of Air Force wastes in trenches including solid wastes potentially contaminated with Agent Orange and dioxins. Subsequent groundwater sampling indicated the presence of solvents, metals, and minute quantities of dioxins. This investigation was designed to further characterize the level and extent of contamination, as well as to identify source(s) of contaminants.

7. Brief resume of key persons, specialists, and individual consultants anticipated for this project.

a. Name & Title:
Frederick S. Hickman
Project Manager

b. Project Assignment:
Environmental Impact Studies

c. Name of Firm with which associated:
Tetra Tech, Inc.

d. Years experience: With This Firm 8 With Other Firms 18

e. Education: Degree(s)/Year/Specialization:
B.A. 1966/Economics
M.A. 1974/Economics

f. Active Registration: Year First Registered/Discipline:

g. Other Experience and Qualifications relevant to the Proposed Project:

Mr. Hickman has 26 years of research and management experience in environmental sciences. He is responsible for the development and preparation of analyses and documents in all environmental science areas. He manages a team of over 30 scientists, economists, planners, and archaeologists and has been responsible for methodology development, scoping and public hearings, impact evaluations, mitigation identification and monitoring, and technical report preparation for several major environmental programs. As a researcher, he as defined numerous analytical programs that provided quantitative and qualitative evaluations for Environmental Assessments and Impact Statements, planning and land use studies, regional economic and demographic analyses, fiscal impact reports, and transportation and infrastructure studies.

Experience relevant to the proposed project includes the following:

- EIS Project Manager for relocation of Los Angeles AFB to March AFB in Riverside County and other locations. This project involved coordination with federal, state, and local agencies on program planning and potential impacts and mitigations for endangered species, wetlands, ground and surface water, air quality, traffic, and growth. A separate fiscal impact analysis for local jurisdictions was also prepared.

- Manager of Social Sciences group and principal economist for environmental studies required for the USAF peacekeeper and Small Missile programs. Principal socioeconomic investigator and resource manager supervisor for EIS preparation, environmental baseline characteristics, and public and agency coordination. Provided direct management of field studies and impact analyses for the issues of regional economics, demographics, public services and finance, housing, land use, recreation, transportation, utilities and energy, and cultural resources. Designed and implemented a community monitoring program to provide ongoing measurement of the effects of the project on the local community.

- Project Manager for the Programmatic Environmental Assessment (EA) of the Installation Restoration Program (IRP) at Edwards AFB, CA. This EA will evaluate the environmental consequences of investigation and remediation processes and technologies applicable for operable units on Edwards AFB and determine appropriate mitigations and best management practices to avoid all potential significant impacts.

- Project Manager for Socioeconomic Impact Analysis Study for England AFB, LA and Bergstrom AFB, TX including the evaluation of base closure and alternative reuse impacts on population and employment, housing, public services, and public finance.

APPENDIX J

MDNR LEAKING UNDERGROUND STORAGE TANK SOIL CLEANUP GUIDELINES FOR UNDISTURBED SOILS

Leaking Underground Storage Tank Soil Cleanup Guidelines for Undisturbed Soil

Site Features	Score 15 if True		Score 10 if True		Score 5 if True		Score 0 if True	
Groundwater potable?	No	15	Unknown		Poor		Yes	
Depth to groundwater?	> 100 ft		51-100 ft		25-50 ft		< 25 ft	0
Natural fractures present?	None		Unknown	10	Present		Predominant	
Man-made vertical conduits?	None	15	Unknown		Present		Predominant	
Man-made horizontal conduits?	None		Unknown		Present		Predominant	0
Coarse soil or sand present?	None	15	Unknown		Present		Predominant	
Water wells nearby?	> 1000 ft away	15	501-1000 ft away		100-500 ft away		< 100 ft away	
Background levels present?	Above action levels		Unknown	10	Below action level		Nondetectable	
Subtotals		60		20				0
						Total Score =		80

Soil Cleanup (ppm)				
Total Score	101-120	71-100	41-70	40 or less
BTEX =	2/10/50/50	1/5/10/10	0.5/1/2/2	B+T+E+X < 2
TPH =	500	200	100	50

APPENDIX K

AUDITS

110173

TETRA TECH, INC.
348 West Hospitality Lane, Suite 300
San Bernardino, CA 92408-3216
Telephone (909) 381-1674
FAX (909) 889-1391

TO: Julie Westhoff, Pam McKee, Project Managers DATE: 30 March 1994

Kansas City, KS

FROM: Arlen Saxton, Field Auditor APPROVAL GHK

SUBJECT: Field Audit of the Richards-Gebaur AFB Hydrant Line Activities

On March 24 and 25, 1994, a field QA audit was performed at the Richards-Gebaur AFB project.

OBSERVATIONS

Prior to field activities on both days, the HNU Photo Ionization Detector was calibrated to manufactures specifications and according to the QAPP for the project. Sample labels and sampling materials were prepared for use.

March 24, 1993: The Layne Western drilling crew began to set-up at the Fire Valve area at approximately 0800. At 0830 drilling began using a 6-inch hollow stem auger fitted with a continuous core sampler. Samples taken out at 0-5 feet depth, 5-10 feet depth and 10-15 foot depths. Auger refusal at 14 feet for all 3 borings this day. At approximately 1530, the Layne Western crew began decon procedures and grouting boreholes.

March 25, 1993: Prior to drilling activities, the chain-link fence needed to be further removed to accommodate the sampling activities. At 0810 drilling began, using a 4-inch auger. Samples taken at 3 feet, 5 feet and 8 feet. At approximately 0930, move off Fire Valve Line and set-up at gas line. At 1000 drilling resumed at gas line.

For the Drainage Pond project, the crew members will be the same and as such, it can be determined that the same quality work will be performed during the Drainage Pond project.

CONCLUSIONS

Sample preparation, sampling technique, sample handling, record keeping and decon procedures followed the Richards-Gebaur AFB Work Plan, Sampling and Analysis Plan, Field Sampling Plan and Quality Assurance Project Plan.

Clearly, this qualified crew knew and adhered to the site plans. No discrepancies were noted. A job very well done to Pam McKee, Julie Westhoff and crew.

AWS.mlk
AWS-068

cc: Brownlie, W Ph D , Tt SBO
Kassakhian, G. Ph.D., Tt SBO
Krohn, R., Kansas City
Pacheco, S., Tt SBO

110174

FIELD ACTIVITIES
RECORD KEEPING AUDIT CHECKLIST

Contract: 9570 Date: 03/25/94

Site: Richards-Gebaur AFB Auditor: Arlen Saxton

Yes	No	Location of Record Comments	Record Keeping Requirement
			EQUIPMENT CALIBRATION
X		PID	1. FID or PID pre calibrated?
X			post calibrated?
			Standards used
		N/A	2. pH Meter pre calibrated?
			post calibrated?
			Standards used
		N/A	3. Conductivity Meter
			pre calibration check?
			post calibration check?
			Standards used
		N/A	4. Turbidimeter standardization check?
		N/A	5. CGI Meter pre calibration?
			post calibration?
			Standards used
			FIELD RECORDS
X			1. Name & Address of Field Contact on log book cover.
X			2. Date of Entry
			a) Log Book
			b) FDS
			c) Others:
			Specify 1) Borehole Log 2)
			3. Names and affiliations of personnel on site.
X		Layne Western Drilling Contractor	

AWS-068

Yes	No	Location of Record Comments	Record Keeping Requirement
X			4. Description of Field Activities.
X			5. Weather conditions.
X			6. Location of activity.
X			7. Observations of activities environment.
X			8. Identification of Sampling Device.
X			9. Any field measurements taken.
X			10. Sequence of sample collection.
X			11. Type of Sample Matrix.
X			12. Date and Time of sample collection.
X			13. Field sample I.D.#.
X		On C-O-C	14. Sample distribution.
X			15. Samplers name.
X			16. Sample type (replicate, QA/QC, etc.)
X		N/A	17. For Groundwater:
			a) Were samples filtered?
			b) Screen type & Size noted?
			c) Preservatives used noted?

Yes	No	Location of Record Comments	Record Keeping Requirement
X	___		18. Each page in log book signed or initialled?
___	___	N/A	19. Are corrections correctly lined out and initialled?
___	___		20. If information is not in log book, It is referenced to another data sheet?
			PHOTOGRAPHS
X	___		1. Roll and Frame number recorded.
X	___		2. Time and date recorded.
X	___		3. Photographer noted.
X	___		4. Location of photograph noted.
X	___		5. Subject of photograph noted.
X	___		6. Significant or relevant features noted.
X	___		7. Names of personnel in photograph, if any.

Additional comments:

110177

ENVIRONMENTAL SOIL SAMPLING SYSTEMS AUDIT CHECKLIST

Contract: 9570 Date: 25 March 1994

Site: Richards-Gebaur AFB Auditor: Arlen Saxton

Yes	No	Comments	Operation
			PRESAMPLING OPERATIONS
X		Continuous Core Soil	1. Sample type? (specify)
X			2. Qualified personnel?
X			3. Adequate facilities, equipment, and supplies?
X		Decon Performed in Accordance with RGAFB FSP	4. Decontamination performed according to current procedure? (Soap, potable water, Type II, reagent grade water, methanol, hexane.)
X			5. Sampling locations properly specified?
X		Final Nov 1993	6. Copy of task instructions or QAPP? Revision # Final Draft - December 1993
X		N/A	7. Copy of daily sampling schedule?
			SAMPLING OPERATIONS
X			1. Samples collected at proper sampling locations?
X			2. Appropriate sample technique used to obtain representative sample?
X			3. Appropriate techniques used to ensure sample integrity and avoid contamination?
X			4. At least 10% replicate/duplicate samples collected?
X			5. Sufficient volume of sample collected?

<F \ADMIN\HAZ\F-1111S> 11/10/93

Yes	No	Comments	Operation
X			6. Suitable sample container used for storage?
X			7. Sample containers properly labeled?
X		PID, Hnu Used	8. OVA measurements taken and recorded prior to sampling and every 30 minutes during sampling?
			POST-SAMPLING OPERATIONS
X		Decon Performed in Accordance with RGAFB FSP	1. Decontamination performed according to current procedure? (Soap, potable water, Type II, reagent grade water, methanol, hexane.)
X			2. Sampling date, time, and location properly recorded in logbook?
		N/A, Samples Hand Delivered to Lab	3. Suitable sample shipping container label used?
X			4. Chain-of-Custody form filled out?
	X	N/A	5. Chain-of-Custody seal affixed to sample container?
X			6. Refrigerated sample storage?
X			7. Overall recordkeeping procedure adequate?

Additional comments:

APPENDIX L

U.S. EPA POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM

110180

OMB Approval Number: 2050-0095
Approved for Use Through: 1/92

EPA Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State	CERCLIS Number

CERCLIS Discovery Date:

1. General Site Information

Name	Street Address.
Richards-Gebaur AFB IRP Site SS009	

City	State.	Zip Code.	County	Co Code	Cong Dist.
Kansas City	MO	64147	Jackson		

Latitude	Longitude	Approximate Area of Site	Status of Site
~~38~~ ° ~~51~~ ' ~~1.0~~ "	94 ° 33 ' 0 . _ "	_____ Acres 1,200 Square Ft	☐ Active ☐ Not Specified ☒ Inactive ☐ NA (GW prime etc.)

2. Owner/Operator Information

Owner	Operator
U.S Air Force	same as owner
Street Address: 15471 Hangar Road	Street Address:
City: Kansas City	City:
State: MO; Zip Code: 64147; Telephone: (816) 348-2511	State: ; Zip Code: ; Telephone: ( )

Type of Ownership
- ☐ Private
- ☒ Federal Agency
  - Name: _____
- ☐ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other: _____

How Initially Identified
- ☐ Citizen Complaint
- ☐ PA Petition
- ☐ State/Local Program
- ☐ RCRA/CERCLA Notification
- ☒ Federal Program
- ☐ Incidental
- ☐ Not Specified
- ☐ Other: _____

3. Site Evaluator Information

Name of Evaluator	Agency/Organization	Date Prepared
	Tetra Tech	03 June 1994

Street Address	City	State
10 E. Cambridge Circle Dr.	Kansas City	KS

Name of EPA or State Agency Contact	Street Address
NA	

City	State	Telephone
		( )

4. Site Disposition (for EPA use only)

Emergency Response/Removal Assessment Recommendation
- ☐ Yes
- ☐ No

Date: _____

CERCLIS Recommendation
- ☐ Higher Priority SI
- ☐ Lower Priority SI
- ☐ NFRAP
- ☐ RCRA
- ☐ Other: _____

Date: _____

Signature

Name (typed)

Position

EPA Potential Hazardous Waste Site
Preliminary Assessment Form - Page 2 of 4

CERCLIS Number

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site (check all that apply)
- [X] Industrial
- [X] Agriculture
- [ ] DOI
- [ ] Commercial
- [ ] Mining
- [ ] Other Federal Facility
- [ ] Residential
- [X] DOD
- [ ] Forest/Fields
- [ ] DOE
- [ ] Other

Site Setting
- [ ] Urban
- [X] Suburban
- [ ] Rural

Years of Operation
Beginning Year 1951
Ending Year
[ ] Unknown

Type of Site Operations (check all that apply).
- [ ] Manufacturing (must check subcategory)
  - [ ] Lumber and Wood Products
  - [ ] Inorganic Chemicals
  - [ ] Plastic and/or Rubber Products
  - [ ] Paints, Varnishes
  - [ ] Industrial Organic Chemicals
  - [ ] Agricultural Chemicals (e.g., pesticides, fertilizers)
  - [ ] Miscellaneous Chemical Products (e.g., adhesives, explosives, ink)
  - [ ] Primary Metals
  - [ ] Metal Coating, Plating, Engraving
  - [ ] Metal Forging, Stamping
  - [ ] Fabricated Structural Metal Products
  - [ ] Electronic Equipment
  - [ ] Other Manufacturing
- [ ] Mining
  - [ ] Metals
  - [ ] Coal
  - [ ] Oil and Gas
  - [ ] Non-metallic Minerals
- [ ] Retail
- [ ] Recycling
- [ ] Junk/Salvage Yard
- [ ] Municipal Landfill
- [ ] Other Landfill
- [X] DOD
- [ ] DOE
- [ ] DOI
- [ ] Other Federal Facility
- [ ] RCRA
  - [ ] Treatment, Storage, or Disposal
  - [ ] Large Quantity Generator
  - [ ] Small Quantity Generator
  - [ ] Subtitle D
    - [ ] Municipal
    - [ ] Industrial
  - [ ] "Converter"
  - [ ] "Protective Filer"
  - [ ] "Non- or Late Filer"
- [ ] Not Specified
- [ ] Other

Waste Generated
- [X] Onsite
- [ ] Offsite
- [ ] Onsite and Offsite

Waste Deposition Authorized By
- [X] Present Owner
- [ ] Former Owner
- [ ] Present & Former Owner
- [ ] Unauthorized
- [ ] Unknown

Waste Accessible to the Public
- [ ] Yes
- [X] No

Distance to Nearest Dwelling, School, or Workplace
25 Feet

6. Waste Characteristics Information

Source Type (check all that apply)	Source Waste Quantity (include units)	Tier*
[ ] Landfill		
[ ] Surface Impoundment		
[ ] Drums		
[ ] Tanks and Non-Drum Containers		
[ ] Chemical Waste Pile		
[ ] Scrap Metal or Junk Pile		
[ ] Tailings Pile		
[ ] Trash Pile (open dump)		
[ ] Land Treatment		
[ ] Contaminated Ground Water Plume (unidentified source)		
[ ] Contaminated Surface Water/Sediment (unidentified source)		
[X] Contaminated Soil		
[ ] Other		
[ ] No Sources		

* C = Constituent, W = Wastestream, V = Volume, A = Area

General Types of Waste (check all that apply)
- [ ] Metals
- [X] Organics
- [ ] Inorganics
- [ ] Solvents
- [ ] Paints/Pigments
- [ ] Laboratory/Hospital Waste
- [ ] Radioactive Waste
- [ ] Construction/Demolition Waste
- [ ] Pesticides/Herbicides
- [ ] Acids/Bases
- [ ] Oily Waste
- [ ] Municipal Waste
- [ ] Mining Waste
- [ ] Explosives
- [ ] Other

Physical State of Waste as Deposited (check all that apply)
- [X] Solid
- [ ] Sludge
- [ ] Powder
- [ ] Liquid
- [ ] Gas

110182

EPA Potential Hazardous Waste Site
Preliminary Assessment Form - Page 3 of 4

CERCLIS Number

7. Ground Water Pathway

Is Ground Water Used for Drinking Water Within 4 Miles
- [ ] Yes
- [X] No

Is There a Suspected Release to Ground Water
- [X] Yes
- [ ] No

List Secondary Target Population Served by Ground Water Withdrawn From.

0 - ¼ Mile	None
> ¼ - ½ Mile	
> ½ - 1 Mile	
> 1 - 2 Miles	
> 2 - 3 Miles	
> 3 - 4 Miles	
Total Within 4 Miles	

Type of Drinking Water Wells Within 4 Miles (check all that apply)
- [ ] Municipal
- [ ] Private
- [X] None

Have Primary Target Drinking Water Wells Been Identified
- [ ] Yes
- [X] No

If Yes, Enter Primary Target Population:

_____ People

Depth to Shallowest Aquifer

200 Feet

Karst Terrain/Aquifer Present
- [ ] Yes
- [X] No

Nearest Designated Wellhead Protection Area.
- [ ] Underlies Site
- [ ] > 0 - 4 Miles
- [X] None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply)
- [X] Stream [X] River [X] Pond [X] Lake
- [ ] Bay [ ] Ocean [ ] Other _____

Shortest Overland Distance From Any Source to Surface Water

_____ Feet

0.5 Miles

Is There a Suspected Release to Surface Water
- [ ] Yes
- [X] No

Site is Located in:
- [ ] Annual - 10 yr Floodplain
- [ ] > 10 yr - 100 yr Floodplain
- [ ] > 100 yr - 500 yr Floodplain
- [X] > 500 yr Floodplain

Drinking Water Intakes Located Along the Surface Water Migration Path:
- [ ] Yes
- [X] No

Have Primary Target Drinking Water Intakes Been Identified.
- [ ] Yes
- [ ] No

If Yes Enter Population served by Primary Target Intakes

_____ People

List All Secondary Target Drinking Water Intakes:

Name	Water Body	Flow (cfs)	Population Served
NA			

Total within 15 Miles _____

Fisheries Located Along the Surface Water Migration Path
- [ ] Yes
- [X] No

Have Primary Target Fisheries Been Identified
- [ ] Yes
- [ ] No

List All Secondary Target Fisheries

Water Body/Fishery Name	Flow (cfs)
NA	

110183

EPA Potential Hazardous Waste Site
Preliminary Assessment Form - Page 4 of 4

CERCLIS Number:

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path
☐ Yes
☒ No

Other Sensitive Environments Located Along the Surface Water Migration Path
☐ Yes
☒ No

Have Primary Target Wetlands Been Identified
☐ Yes
☒ No NA

Have Primary Target Sensitive Environments Been Identified
☐ Yes
☐ No NA

List Secondary Target Wetlands

Water Body	Flow (cfs)	Frontage Miles

List Secondary Target Sensitive Environments

Water Body	Flow (cfs)	Sensitive Environment Type

9. Soil Exposure Pathway

Are People Occupying Residences or Attending School or Daycare on or Within 200 Feet of Areas of Known or Suspected Contamination.
☐ Yes
☒ No

If Yes, Enter Total Resident Population
_____ People

Number of Workers Onsite
☐ None
☒ 1 - 100
☐ 101 - 1,000
☐ > 1,000

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:
☐ Yes
☒ No

If Yes, List Each Terrestrial Sensitive Environment.
_____

10. Air Pathway

Is There a Suspected Release to Air
☐ Yes
☒ No

Enter Total Population on or Within

Onsite	NA
0 - ¼ Mile	
> ¼ - ½ Mile	
> ½ - 1 Mile	
> 1 - 2 Miles	
> 2 - 3 Miles	
> 3 - 4 Miles	
Total Within 4 Miles	

Wetlands Located Within 4 Miles of the Site
☐ Yes
☐ No NA

Other Sensitive Environments Located Within 4 Miles of the Site
☐ Yes
☐ No NA

List All Sensitive Environments Within ½ Mile of the Site

Distance	Sensitive Environment Type/Wetlands Area (acres)
Onsite	
0 - ¼ Mile	
> ¼ - ½ Mile	

NA = Not Applicable

APPENDIX M

HISTORICAL DATA

SS09

CHEMICAL DIVISION

KANSAS CITY TESTING LABORATORY
1669 JEFFERSON
A.C. 816-842-7350
KANSAS CITY, MISSOURI 64108

March 20, 1992

soil from hole @ 60'

Paul Wrabec
Environmental Specialist Inc.
3001 E. 83rd Street
Kansas City, Missouri 64130

Dear Mr. Wrabec:

One soil sample was delivered to Kansas City Testing Laboratory on 3-17-92. The sample was analyzed under KCTL Job No. 8212-92-2026; C2874. The analysis results are detailed below.

BTEX by EPA Method 8020

Sample	Benzene	Toluene	Ethylbenzene	Total Xylenes
Richard Gebaur AFB	< 10	2000	4000	28000

BTEX results are in ug/Kg or parts per billion. Detection limit 10 ppb.

TPH by EPA Method 418.1 with MO-DNR Modification

Sample	TPH (mg/Kg)
Richard Gebaur AFB	(24,870) over

SI → IRA Inter

TPH results are in mg/Kg or parts per million. Detection limit 5 ppm.

Open Cup Flash Point by ASTM D92-85

Sample	Flash Point °F
Richard Gebaur AFB	> 200

APPENDIX N

CLARIFICATIONS TO SOW

RBK-K61-1816

TETRA TECH, INC.
10 East Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
Telephone (913) 621-6041

27 August 1993

Captain J. Bradley Beck
Department of the Air Force
Air Force Center for Environmental Excellence/ESB
8001 Inner Circle Drive, Suite 2
Brooks Air Force Base, TX 78235-5328

Subject: Clarifications to the Statement of Work
Preliminary Assessment/Site Investigation of Site SS009 and
Assessment of Drainage Pond Richards-Gebaur Air Force Base
Contract F33615-90-D-4006, Delivery Order 0008
Tetra Tech, Inc. No. TC 9569

Dear Captain Beck:

This letter discusses the adjustments to our project approach that Tetra Tech has implemented per your request and those that are based on Tetra Tech's professional judgement. These changes reflect clarifications to the requirements listed in the Statement of Work (SOW) for the Preliminary Assessment/Site Investigation (PA/SI) of IRP Site SS009 and the Assessment of the Drainage Pond at Richards-Gebaur Air Force Base (AFB) in south Kansas City, MO. Listed below are the Sections from the SOW that required some form of modification.

Section 1.3 - Project Deliverables

The SOW states "deliver the following documents (Engineering Network Analyses, Work Plan, Letter Report, Technical Report, No Further Action Decision Document, Analytical Data ITIR, and Project Definition ITIR) in compliance with the requirements of item VI, the formats required in sections 1 and 4 of the Handbook, and the specifications noted below." Exceptions to the Handbook-To Support the Installation Restoration Program (IRP) Statements of Work requirements are as follows.

The Outlines for the PA/SI of IRP Site SS009 and the Assessment of the Drainage Pond originally submitted to the USAF by Tetra Tech on 15 July 93 followed those provided in the Handbook for the Work Plan, Sampling and Analyses Plan, and Health and Safety Plan for each site. The only exception was the Work Plans contained tasks for a PA/SI and a RCRA Facility Assessment (RFA) instead of the RI/FS tasks shown in the Handbook.

Soils for volatile organic constituents will be collected in glass jars instead of the brass rings, or equivalent, described in the Handbook. The proposed soil sampling program calls for 3-in diameter continuous samplers (5.0 ft length) for the collection of soil samples. These samplers are not conducive to using brass rings. The proposed field screening program involves first logging the sample, taking an OVA reading, dividing portions of the sample core and placing it into containers, and then conducting a head space analyses. The use of brass rings would interfere with the proposed sampling program by not allowing proper logging and sample collection procedures to obtain representative samples. Brass rings are normally used to prevent the potential loss of volatiles during sample collection but do not allow for the collection of samples from the same interval for multiple analyses. The proposed method will reduce the loss of volatiles by minimally disturbing the soil sample and still allow for multiple sample analyses.

Other Items

Of additional importance are those sections provided in the Handbook for site investigations that will not be implemented by Tetra Tech as they are not stated in the SOW. While this list could be lengthy, the most important section at this time is the one concerning data management. The Handbook states that a data management plan be established to meet the deliverable requirements of the Installation Restoration Program Information Management System (IRPIMS). However, there is no reference to this system in the SOW; therefore, Tetra Tech will not be utilizing such a plan. We have been advised by you that the IRPIMS was intentionally left out of the SOW to reduce costs and in consideration of the Base closure status, IRPIMS would be of limited value. Instead, the data will be submitted in the format of an Analytical Data ITIR, as stated in the SOW.

Please contact me should you have any questions or comments concerning these issues. We felt it was important to document these clarifications to help assure a smooth transition from you to Ms. Butcher.

Sincerely,

Russell B. Krohn
Associate Director

cc: B. Brownlie
L. Hoyt

INSTALLATION RESTORATION PROGRAM (IRP)

PRELIMINARY ASSESSMENT/SITE INSPECTION OF IRP SITE SS009 RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

FINAL

NO FURTHER ACTION DECISION DOCUMENT

29 September 1995

INSTALLATION RESTORATION PROGRAM (IRP)

FINAL

NO FURTHER ACTION DECISION DOCUMENT

FOR

PRELIMINARY ASSESSMENT/SITE INSPECTION
OF
IRP SITE SS009
RICHARDS-GEBAUR AIR FORCE BASE, MISSOURI

Prepared By:

Tetra Tech, Inc.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103
(913) 621-6041

Submitted By:

Air Force Center for Environmental Excellence
Mr. Fred Waterman
Contracting Officers Representative

Prepared For:

Air Force Base Conversion Agency
Richards-Gebaur Air Force Base

29 September 1995

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1 AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	29 September 1995	Final

4 TITLE AND SUBTITLE

Technical Document to Support No Further Action
Fire Valve Area, IRP Site SS009, Richards-Gebaur Air Force Base, Missouri

5 FUNDING NUMBERS

USAF Contract No.
F33615-90-D-4006

6 AUTHOR(S)

Tetra Tech, Inc.

7 PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Tetra Tech, Inc.
10 E. Cambridge Circle Drive
Suite 130
Kansas City, KS 66103

8 PERFORMING ORGANIZATION REPORT NUMBER

N/A

9 SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Center for Environmental Excellence
Environmental Services Office
Base Closure Restoration Division (AFCEE/ESB)
Brooks Air Force Base, Texas 78235-5328

10 SPONSORING/MONITORING AGENCY REPORT NUMBER
SPONSORING/MONITORING AGENCY REPORT NUMBER

N/A

11 SUPPLEMENTARY NOTES

12a DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release. Distribution is Unlimited.

12b DISTRIBUTION CODE

13 ABSTRACT *(Maximum 200 words)*

This document supports the decision that no further action is warranted for the soils at the Fire Valve Area, IRP Site SS009, Richards-Gebaur Air Force Base, MO.

14 SUBJECT TERMS

No Further Action Decision Document

15 NUMBER OF PAGES

16 PRICE CODE

17 SECURITY CLASSIFICATION OF REPORT	18 SECURITY CLASSIFICATION OF THIS PAGE	19 SECURITY CLASSIFICATION OF ABSTRACT	20 LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

TECHNICAL DOCUMENT TO SUPPORT NO FURTHER ACTION

DECLARATION

SITE NAME AND LOCATION

The Fire Valve Area, Installation Restoration Program (IRP) Site SS009, is located in the central portion of Richards-Gebaur AFB, Missouri. Richards-Gebaur AFB is a former Air Force Reserve Base located in west-central Missouri, approximately 18 miles south of downtown Kansas City and three miles from the Kansas State line. The Base is bounded by the City of Belton on the east and south, and is surrounded by Kansas City to the north and west. The Fire Valve Area is located at the edge of the Civil Engineering Complex, directly behind (southwest side) Building 605.

STATEMENT OF BASIS

The No Further Response Action Planned (NFRAP) decision for soils at the Fire Valve Area is based on the results of the Preliminary Assessment/Site Inspection (PA/SI) of the Fire Valve Area completed between 1993 and 1995. The PA/SI included a literature search to obtain background information; field investigations to determine whether contamination remained in the Fire Valve Area and the source of that contamination; development of a conceptual site model; and completing a qualitative risk assessment to estimate the potential risk posed by the site to public health and the environment.

DESCRIPTION OF SELECTED REMEDY

The conceptual site model and qualitative risk assessment identified current and potential exposures, and evaluated potential risk associated with the Fire Valve Area. The only potential receptors identified through the qualitative risk assessment were utility workers conducting maintenance along the water line, however, their risk is considered minimal as the major contaminant identified above levels of concern was total petroleum hydrocarbons (TPH). Only one soil sample collected from a depth of 4.5 feet exceeded the regulatory cleanup level of 200 ppm TPH. In addition, maintenance on the line would be intermittent, occurring on an as-needed basis.

Therefore, based on the current conditions at the Fire Valve Area, no significant risk or threat to public health or the environment exists with respect to the soils The selected remedy for the soils in the Fire Valve Area is a no further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. However, the groundwater system underlying the Fire Valve Area requires further study and is not included in this NFRAP decision.

DECLARATION

The NFRAP decision represents the selected action for the Fire Valve Area site and has been developed in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Contingency Plan (NCP). The selected

remedy of no further action with respect to soils is consided protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate, and is cost-effective. The statutory preference for further treatment is not satisfied because further treatment was not found to be necessary for soils. Contaminant levels in the soils at the site have been determined to present no significant threat to human health or the environment; thus, no treatment is necessary.

Russell B. Kuhn Date: 29 September 1995

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

List of Figures

List of Tables

1.0 INTRODUCTION

This Decision Document (DD) supports the no action alternative for IRP Site SS009-Fire Valve Area, at Richards-Gebaur Air Force Base (AFB), Missouri. Richards-Gebaur AFB is a former Air Force Reserve Base located in west-central Missouri, approximately 18 miles south of downtown Kansas City and three miles from the Kansas state line (Figure 1.0). The Fire Valve Area, Site SS009, is located at the edge of the Civil Engineering Complex, directly behind (southwest side) Building 605 (Figure 2.0).

The purpose of the DD is to summarize the existing data for the site and to describe the Air Force's rational for selecting the no further action alternative with respect to soils in the Fire Valve Area. The objectives of the DD for the Fire Valve Area are:

1. To briefly describe the location, history, and environmental setting of the Fire Valve Area at Richards-Gebaur AFB;

2. To describe the current status of the site based on Tetra Tech's Preliminary Assessment/Site Inspection conducted in 1994; and

3. To assess the risk to human health and the environment.

Data resulting from the Preliminary Assessment/Site Inspection (PA/SI) by Tetra Tech, Inc. (1995) were used to derive and support the no action alternative for soils at the Fire Valve Area. Data are included in the PA/SI report (Tetra Tech, 1995) describing the investigation and results.

2.0 COMMUNITY PARTICIPATION

There has been no community involvement in the Preliminary Assessment/Site Inspection of the Fire Valve Area at Richard-Gebaur AFB, MO.

3.0 SITE DESCRIPTION

The Fire Valve Area, Site SS009, is located at the edge of the Civil Engineering Complex, directly behind (southwest side) Building 605 (Figure 2.0). During excavation by an Air Force contractor in March 1992 to repair an underground water main valve, petroleum product was discovered. Approximately 10 cubic yards of soil were removed and the excavation was backfilled with clean fill without adequate documentation to confirm clean. The excavated soils were tested and contaminant levels exceeded the State of Missouri's cleanup levels for benzene/toluene/ethyl benzene/xylene (BTEX) and total petroleum hydrocarbons (TPH). The source of the petroleum contamination and the possibility that contaminated soils remained in the Fire Valve Area surrounding the original excavation were investigated as part of the PA/SI

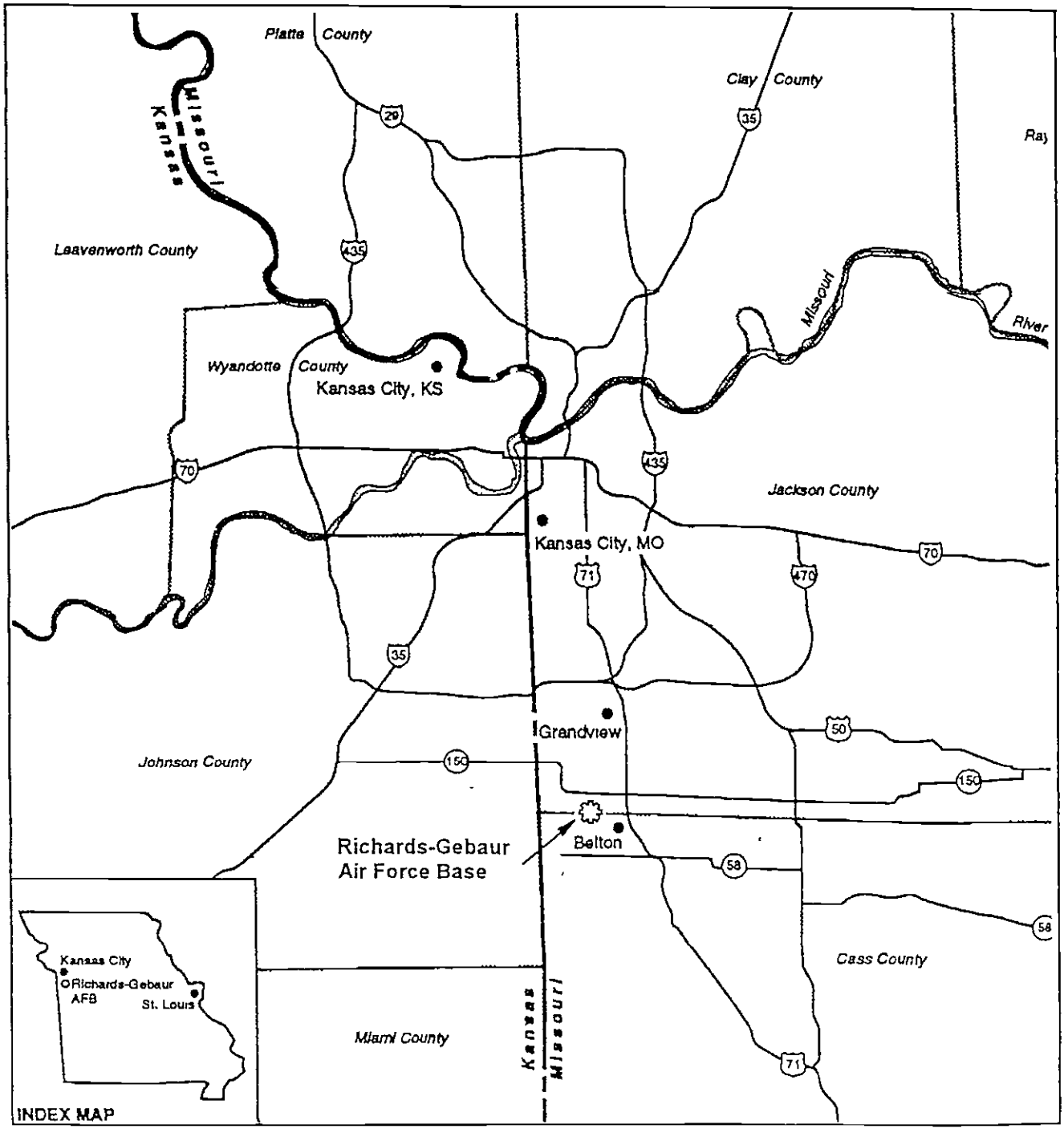


Figure 1.0
Richards-Gebaur Air Force Base, Missouri

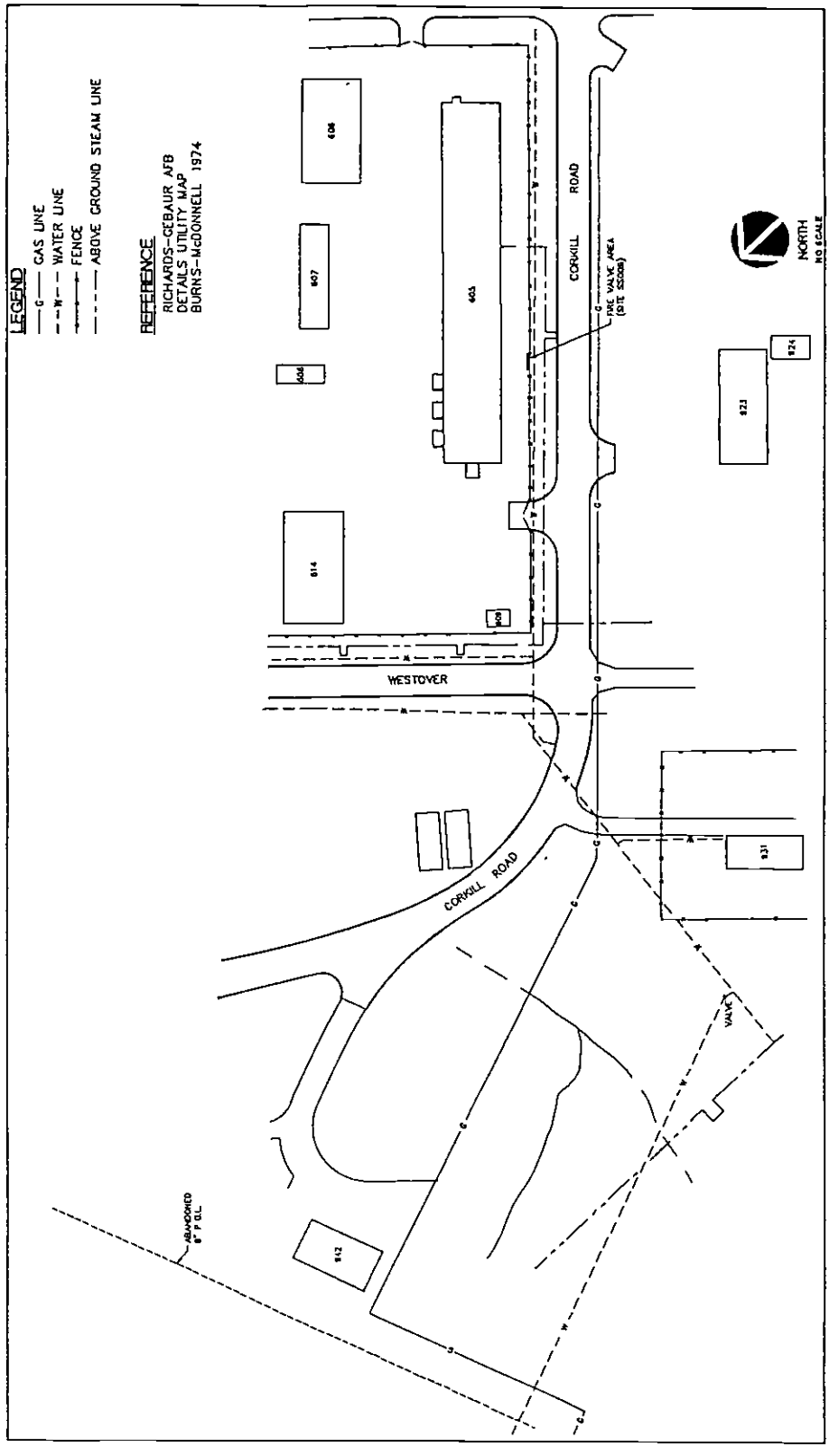


Figure 2
Location of the Fire Valve Area
Richards-Gebaur Air Force Base, Missouri

3.1 Topography and Climatology

Topography

The topography of Richards-Gebaur AFB is gently rolling with an average elevation of approximately 1,000 feet above mean sea level. The regional terrain is characterized by a nearly level plain that has been incised by tributaries of the Missouri River, resulting in rolling hills with relative relief ranging from 50 feet to 150 feet. The Base is situated on the south-central portion of a broad plateau known as the Blue Ridge, with the Blue River to the west and the Little Blue River to the east. The Blue River basin and the Little Blue River basin provide drainage for the area. Both rivers flow to the northeast into the Missouri River, located approximately 20 miles north of the Base. Within this drainage basin, Base storm water flow is generally toward Scope Creek, which flows from south to northeast through the Base.

Climate

The following climate information was also obtained from the Soil Survey of Jackson County (SCS, 1984). The consistent pattern of climate in Jackson County, MO and for Richards-Gebaur AFB is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early summer. In winter, the average temperature is 33 degrees F, and the daily minimum average temperature is 24 degrees. In summer, the average temperature is 78 degrees F., and the average daily maximum temperature is 88 degrees F. The total annual precipitation is 35.75 inches, of which 70 percent falls in April through October. Peak precipitation occurs in the spring and fall, whereas summer rainfall events are intermittent. The average seasonal snowfall is 22 inches. The average relative humidity in mid-afternoon is about 60 percent; humidity is higher at night, and the average at dawn is about 80 percent. Prevailing winds are from the south.

3.2 Geology/Hydrogeology

Geology

Richards-Gebaur AFB is located within the Osage Plains region of the Central Lowland physiographic province. The region is characterized by low relief, wide, maturely dissected uplands, and relatively steep valley slopes. Within Jackson and Cass counties, sedimentary rocks of Pennsylvanian age (Kansas City Group) comprise the uppermost geologic units and reach a thickness of about 500 to 900 feet. In general, the rock strata dip toward the northwest at about 10 feet per mile. The regional dip may be modified locally by low anticlines, synclines, and domes. Richards-Gebaur AFB is located on the King anticline, a structural rise favorable for oil and gas production and the oldest gas producing area in Cass County; however, gas production ended in 1938 (CH2M Hill, 1983).

The geology of the Base is characterized by very thin loess deposits over residual soils derived from the in-place weathering of the underlying limestones and shales. Rock outcrops are found along Scope Creek. Exposed rocks include the Wyandotte Formation (Argentine Limestone Member), Lane Formation, the Iola Formation (Raytown Limestone Member), and the Chanute Formation.

The Argentine Limestone Member of the Wyandotte Formation is the predominant rock unit and caps most of the upland areas. The unit consists of a highly weathered limestone that reaches a

maximum thickness of about 50 feet. Weathering has produced enlarged, clay-filled, vertical joints and layers of soft clay along horizontal bedding planes. Groundwater moves through these joints and planes where conditions permit. The Lane Formation underlies the Wyandotte Formation and is described as a grey micaceous shale of generally low permeability with several feet of cross-bedded sandstone near the top of the Formation. The thickness of the Lane Formation ranges from 20 to 60 feet and outcrops on the Base range from 35 to 45 feet. The Raytown Limestone Member of the Iola Formation is a thin limestone unit about 10 feet thick that outcrops along the banks of Scope Creek. The Chanute Formation, comprised primarily of shale with interbedded limestone stringers, underlies the Raytown Limestone Member. The Chanute Formation is not exposed at the Base but is covered by alluvial soils along Scope Creek. Rock units underlying these formations consist of sedimentary rocks overlying a Precambrian basement rock of granite at depths greater than 2,500 feet (Gentile, 1984 and CH2M Hill, 1983).

The bedrock underlying the Fire Valve Area was not cored during the PA/SI; drilling advanced to bedrock/auger refusal at a depth of 14 feet below ground surface with weathered limestone fragments recovered in the sampler at 14 feet below ground surface. The soil borings for the PA/SI (B1 through B4) describe a greenish-gray clay grading to a tan clay at approximately 8 to 10 feet. The tan clay from 10 to 14 feet below ground surface was described as having a platy weathered bedrock texture with limestone fragments at its base. The Fire Valve Area appears to be underlain by the Raytown Limestone Member.

Hydrogeology

Regionally, Richards-Gebaur AFB is located within the Osage-Salt Plains groundwater area of the Central Nonglaciated Plains groundwater region. The Osage-Salt Plains area is characterized by Pennsylvanian and Mississippian sandstone and limestone aquifers that yield water from shallow wells at low rates; wells deeper than 400 feet yield non-potable, mineralized water. Total dissolved solids exceed 1,000 ppm in aquifers capable of yielding adequate water volumes to municipalities or industries. In southwest Jackson County and northwest Cass County, the total dissolved solids may exceed 40,000 ppm.

The shallow groundwater aquifers present in the uppermost limestone formations of Pennsylvanian age have been used in some areas of Jackson and Cass Counties for domestic use, but yields are very low [1 to 3 gallons per minute (gpm)], quantities are seasonal, and the water quality is highly mineralized (CH2M Hill, 1983). There are no water supply wells at Richards-Gebaur AFB. Recharge occurs in outcrop areas and by percolation through overlying strata where joints, fractures, or faults are present Release of groundwater in storage from the shales is slow, limiting the usefulness of the limestones as water supply aquifers. Groundwater discharge from the shallow limestones and shales occurs in outcrop areas along the Missouri River and its tributaries, including Scope Creek

The depth to groundwater across the Base is generally shallow (several feet to approximately 30 feet) and varies over short distances. A seasonal variation in groundwater elevation is observed (seasonal high depth to water of approximately two to four feet below ground surface), as well as a variation with the topography, with groundwater being deeper in areas of higher topography. The general direction of groundwater flow across the Base in the shallow limestone and shale units is towards Scope Creek The major discharge area available to the upper limestones and shales is Scope Creek through seeps and possibly springs along upland drainages.

3.3 Soils

According to the Soil Survey of Jackson County (SCS, 1984), the soils at the Fire Valve Area belong to the Macksburg-Urban series, which is defined as being gently sloping, poorly drained silt and silt clay loams, typically 2 to 15 feet thick, covered in places by urban features. Permeability is moderate and surface runoff is medium. Organic matter content is moderate.

The soils in the immediate area of the Fire Valve Area were dark, mottled, greenish-grey to greenish-brown, dense, plastic clays overlying a mottled tan to tannish-grey, dense, plastic clay at a depth of approximately 10 feet. The base of the tan clay contained up to one-inch fragments of angular to subangular chert and limestone, with auger refusal at 14 feet. The soils to the northwest of the intersection of Corkill and Westover roads are comprised of reddish-brown to dark brown clay overlying the tan clay at a depth of approximately five feet. To the southeast of the Fire Valve Area, the tan clay was encountered just beneath the surface soil and gravel.

4.0 CHARACTERIZATION OF THE SITE

During the PA/SI, soil borings were drilled and sampled to further characterize the site geology/hydrogeology and determine the presence of contamination in the Fire Valve Area. A total of four soil borings were drilled and continuously sampled to a depth of approximately 14 feet, where auger refusal due to bedrock was encountered; these borings were located adjacent to the original excavation at the Fire Valve Area. As contamination was only observed in one of the four soil borings (FVB-3), which was located adjacent to the water line and to the northwest of the Fire Valve Area, field screening borings (a total of 18) were then drilled and sampled to determine if the source of contamination was outside the Fire Valve Area.

Drilling continued to the northwest along the gas line to Building 942, and along the water line to just north of the drainage ditch. A total of 15 field screening borings were drilled along the gas and water conduits towards the abandoned Petroleum, Oil, and Lubricant (POL) line to determine if the line was a source; however, contamination was not detected or observed beyond the water line adjacent to Building 605. Three additional field screening borings (FSB-16 through 18) were then drilled to the southeast of the Fire Valve Area to determine the extent of the contamination observed in the water line trench. Hydrocarbon contamination was observed in boring FSB-17; however, contamination was not detected in FSB-18, which was located approximately 200 feet from the Fire Valve Area. Based on the distance of FSB-18 from the Fire Valve Area and its location with respect to Building 605 (south of the Building's corner), the extent of contamination appeared to be defined along the water line. The boring locations and TPH levels are shown on Figure 3.0.

Based on the analytical results of the PA/SI, the major contaminants for the Fire Valve Area are the TPH extractable compounds. Contaminant concentrations are shown on Tables 1 and 2. The TPH extractables generally indicate fuel contamination, such as diesel or kerosene. TPH purgeables are usually indicative of gasoline components and were not detected in any of the samples analyzed. The contamination does not appear to be continuous within the water line trench, as samples collected from FSB-2 and FVB-4 did not detect hydrocarbon contamination during field efforts or laboratory analyses; this may indicate more than one spill event. TPH extractables were detected in sample intervals ranging from 3 to 5 feet and 7 to 8 feet below ground surface but not below 10 feet, as observed in FVB-3.

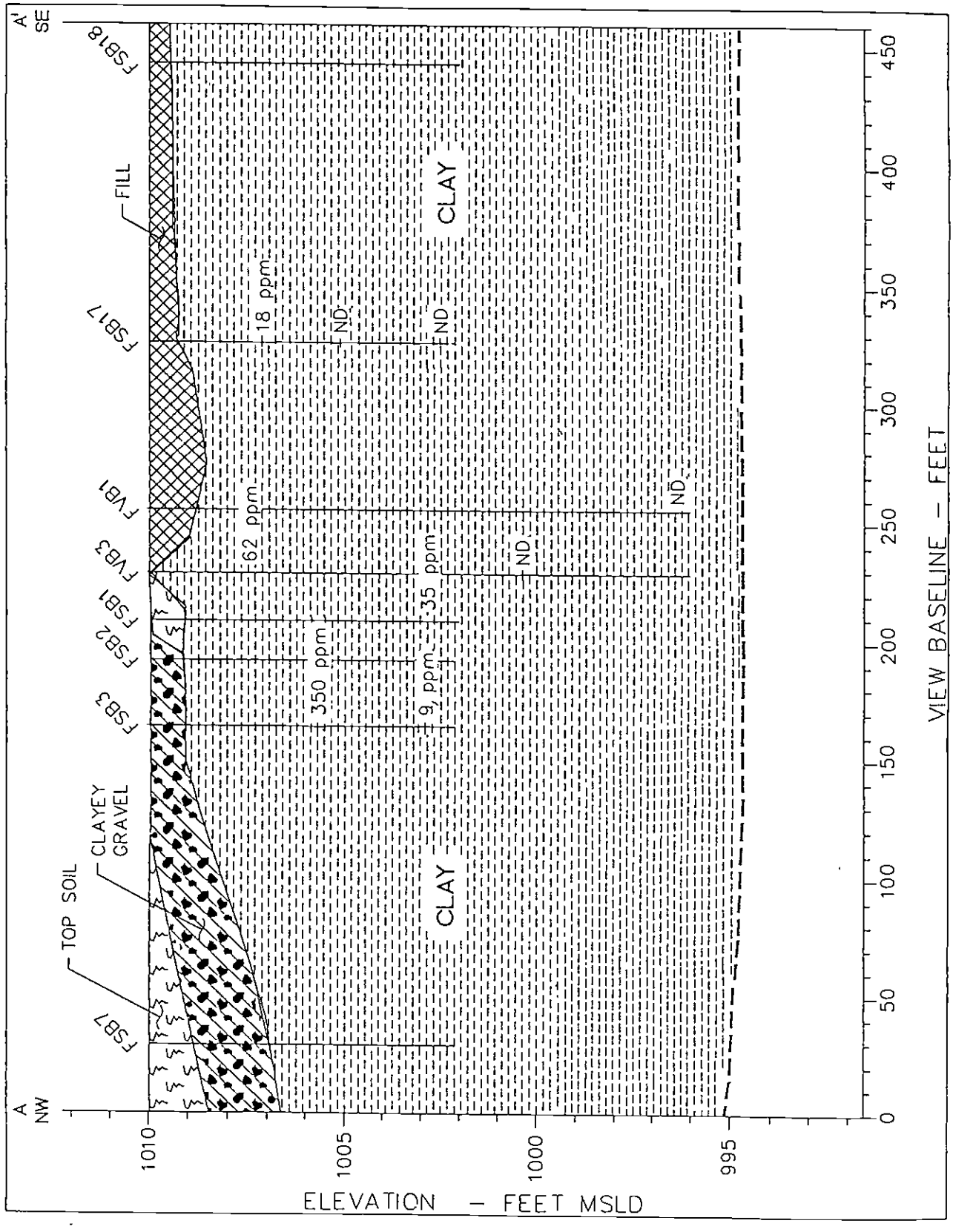


Figure 3
TPH Concentrations by Borehole Location

Table 1. Volatile Organic Results (mg/kg dry)
Soil Samples From Fire Valve Area-RGAFB

Sample ID	Acetone		Chloroform		1,2-Dichloropropane		Ethylbenzene		2-Hexanone		Methylene chloride		MIBK		1,1,2,2-Tetrachloroethane		Total Xylenes		BTEX*
FV-B1-13	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 014)	U	0.009	BJ	(0 013)	U	(0 006)	U	(0.006)	U	ND
FV-B2-13	(0 032)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 013)	U	(0 006)	U	(0.012)	U	(0 006)	U	(0.006)	U	ND
FV-B3-3	(0 033)	U	0 011		0 007		0 019		0.029		(0 006)	U	(0 013)	U	0.006	J	(0.006)	U	0.019
FV-B3-10	(0 032)	U	(0.006)	U	(0 006)	U	(0 006)	U	(0 014)	U	(0 006)	U	(0.012)	U	(0 006)	U	(0 006)	U	ND
FV-B4-3	(0 034)	U	(0 007)	U	(0 007)	U	(0 007)	U	(0 014)	U	(0 007)	U	(0 013)	U	(0 007)	U	(0.007)	U	ND
FV-B4-12 5	(0 030)	U	(0 006)	U	(0 006)	U	(0.006)	U	(0 013)	U	(0 006)	U	(0 011)	U	(0.006)	U	(0 006)	U	ND
FV-B5-3	(0 035)	U	(0 007)	U	(0 007)	U	0 012		0.038		0.010	B,J	0 014	U	(0 007)	U	(0 007)	U	0.012
FV-FSB1-7 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 014)	U	(0 006)	U	(0 013)	U	(0 006)	U	(0 006)	U	ND
FV-FSB3-4 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	0.018		0.009	BJ	(0 013)	U	(0.006)	U	(0 006)	U	ND
FV-FSB3-7 5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 014)	U	(0.006)	U	(0 013)	U	(0.006)	U	(0 006)	U	ND
FV-FSB5-4 5	(0 032)	U	(0 006)	U	(0 006)	U	(0 006)	U	(0 014)	U	(0 006)	U	(0 012)	U	(0 006)	U	(0 006)	U	ND
FV-FSB8-2 5	(0 033)	U	(0 006)	U	(0 006)	U	0 036		0.027		(0.006)	U	(0 013)	U	(0 006)	U	0.068		0.104
FV-FSB10-4 5	(0 034)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0 014)	U	(0.006)	U	(0 013)	U	(0 006)	U	(0 006)	U	ND
FV-FSB14-7.5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0 014)	U	(0.006)	U	(0 013)	U	(0 006)	U	(0 006)	U	ND
FV-FSB17-2.5	0 032	B	(0 006)	U	(0 006)	U	(0 006)	U	ND (0.014)	U	0.008		(0 013)	U	(0 006)	U	(0.006)	U	ND
FV-FSB17-4 5	0.14	B	(0 007)	U	(0 007)	U	0.01		0.037		0.013		0.14		(0 007)	U	0.045		0.055
FV-FSB17-7.5	0.08	B	(0 006)	U	(0 006)	U	(0 006)	U	ND (0 014)	U	0.010		(0 013)	U	(0 006)	U	(0.006)	U	ND
FV-FSB18-4.5	(0 033)	U	(0 006)	U	(0 006)	U	(0 006)	U	ND (0 014)	U	0.007	BJ	(0 013)	U	(0 006)	U	(0 006)	U	ND

Note Volatile organic compounds not shown were not detected above their respective Practical Quantitation Limits (PQL)
Bolded values were detected above the PQL
* BTEX = Sum of benzene, toluene, ethylbenzene, and total xylenes
Values in parentheses are PQLs for those compounds
ND = Not detected above PQL
Data Validity Qualifiers:
B = The environmental sample result is less than five or ten times (for common laboratory contaminants) the blank acceptance level. The usability of the data could be limited since this qualifier is not based on the instrument calibration (initial and continuing calibration verification and initial and continuing calibration blank) nor internal standard data review.
J = The results are deemed qualified and usability of the data limited J is also used when the analyte results are between the Method Detection Limit (MDL) and the PQL
U = The analyte was analyzed for, but was not detected above the MDL and was reported as Not Detected.

Table 2. Total Petroleum Hydrocarbons and Semi-volatile Organic Results (mg/kg dry)
Soil Samples From Fire Valve Area-RGAFB

Sample ID	TPH (Extractable)		TPH (Purgeable)		Acenaphthene		Anthracene		2,4-Dinitrotoluene		Fluorene		2-Methylnaphthalene		N-nitroso-diphenylamine		Naphthalene		Phenanthrene	
FV-B1-13	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U
FV-B2-13	(6)	U	(6)	U	(0.3)	U	(0.3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U
FV-B3-3	62		(6)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	**0.79**		(0 4)	U	**0.31**	J	(0 4)	U
FV-B3-10	(6)	U	(6)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U
FV-B4-3	(6)	U	(7)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U
FV-B4-12 5	(5)	U	(6)	U	(0 3)	U	(0.3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 4)	U
FV-FSB1-7 5	35		(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB3-4 5	370		(6)	U	**0.20**	J	**0.23**	J	**0.34**	J	**0 36**	J	(0 4)	U	**0.61**		(0 4)	U	**0.68**	
FV-FSB3-7 5	9		(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB5-4 5	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB8-2.5	(6)	U	(6)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0.4)	U
FV-FSB10-4 5	(6)	U	(6)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0.4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U
FV-FSB14-7 5	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0.4)	U	(0.4)	U	(0 4)	U
FV-FSB17-2 5	18		(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0 4)	U
FV-FSB17-4 5	(7)	U	(7)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U
FV-FSB17-7.5	(6)	U	(6)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0 4)	U	(0.4)	U	(0 4)	U	(0.4)	U	(0 4)	U
FV-FSB18-4 5	(6)	U	(6)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U	(0 3)	U

Note. Semi-volatile organic compounds not shown were not detected above their respective Practical Quantitation Limits (PQL)

Bolded values were detected above the PQL

ND = Not detected above PQL

Values in parantheses are PQLs for those compounds

Shaded values exceed applicable action levels

Values in parentheses are PQLs for those compounds

Data Validity Qualifiers:

J = The results are deemed qualified and the usability of the data limited. J is also used when the analyte results are between the Method Detection Limit (MDL) and the PQL

U = The analyte was analyzed for, but was not detected above the MDL and was reported as Not Detected.

5.0 MIGRATION PATHWAYS

Potential migration of contaminants detected in the Fire Valve Area is discussed in this section of the report. The potential for receptor exposure to contaminants is described in terms of the properties of the detected contaminants and the four environmental media by which contaminants migrate: soil, groundwater, air, and surface water.

5.1 Soil Exposure Pathways

The PA evaluation of the soil exposure pathway considers the likelihood of exposure and targets. Targets are based on populations located on or within 200 feet of the site, and those populations within the surrounding area coming into contact with site contamination. For the Fire Valve Area, contaminated soil was observed at depths ranging from three to eight feet below ground surface. At this time, it appears that the only group of receptors likely to contact subsurface soils in this area are the utility maintenance workers. Maintenance to the water line therefore may result in contaminant exposure via:

- Incidental soil ingestion, and
- Dermal contact with soil.

These contaminant exposure pathways may, therefore, be complete. The typical Base worker, however, is not likely to contact subsurface soils near the Fire Valve Area. Soil exposure pathways are considered incomplete for these workers.

5.2 Groundwater Exposure Pathways

As described above, low levels of several organic compounds have been detected in the soil in the Fire Valve Area. Groundwater contamination has not been investigated. However, there are several factors that suggest contaminants in soil may impact groundwater.

- All of the detected soil contaminants (e.g., xylenes) are relatively soluble in water, and rain infiltration/percolation through the soils could transport contaminants through the unsaturated zone to the shallow aquifer.
- The groundwater underlying the Fire Valve Area is relatively shallow, varying from 3 feet to 30 feet below ground surface.
- Contamination has been found at depths similar to the upper bounds of the saturated zone; contamination may actually be within the aquifer during certain times of the year (e.g., spring and fall).
- Volatile compounds may migrate relatively rapidly in groundwater. Soils at the site may retard transport because of the high clay content and moderate organic content, although contaminants that reach the shallow fractured limestones may move more rapidly.

The extent of groundwater contamination may be limited, though, because of the localized nature of the compounds detected in soils (i.e., there appears to be a relatively small mass of contaminants available for release from soils).

According to the guidance, the depth to the aquifer can be used as an indicator of the likelihood of a release to groundwater. The definition of depth to aquifer is the vertical distance between the deepest point at which hazardous substances are suspected and the top of the shallowest aquifer that supplies drinking water. Therefore, while a release to the groundwater system underlying the Fire Valve Area is possible, the depth to the shallowest aquifer supplying drinking water within a four-mile radius becomes the limiting factor.

Well search information was obtained for a four-mile radius from the Base from a previous site investigation (O'Brien and Gere, October 1991). Wells identified in the search were not active with the exception of one well, which was found to be used as a source of water for irrigation purposes. The well is located approximately 2 miles south of the Fire Valve Area; however, as the well is located across a drainage divide located approximately 1.5 miles south of the Fire Valve Area it is unlikely to be affected by the site. The groundwater south of this divide should follow surface drainage and topography, and flow southward to the Osage River.

The other wells within the area were most likely abandoned due to the easy availability of superior quality water from the municipal water districts. The various municipalities in the area, as well as the Base, obtain water from Kansas City, MO by a series of pipelines. Kansas City obtains water from the Missouri River, which is located approximately 21 miles north of the site. Prior to conversion to municipal water, private wells drew mineralized water from Pennsylvanian shales, fractured limestones, and lenticular sandstones within the shales. Well yields were reported to range from 1 to 20 gallons per minute (gpm).

The shallow groundwater in the Fire Valve Area should generally follow the topography, and flow eastward to Scope Creek. In the Scope Creek drainage, the groundwater may follow the creek flow direction to the northeast. The regional flow direction is not known in the underlying Pennsylvanian age, Kansas City Group bedrock.

Altogether the above factors indicate that contaminants released at the Fire Valve Area could contribute to a complete (potentially limited) exposure pathway, if the groundwater is used as a drinking water source. In other words, contaminated groundwater can only pose a potential health hazard if it is used for potable purposes such as ingestion (drinking water). Receptors must be exposed to any contaminants in the groundwater in order for there to be a complete exposure pathway and for there to be risks associated with groundwater contamination.

Under current conditions, groundwater is not used on the Base. Instead, the Base currently receives drinking water from Kansas City by several pipelines. Kansas City, in turn, obtains water from the Missouri River. Since this PA/SI found only one shallow well (used for irrigation purposes) within four miles of the Base, it does not seem likely that there are any complete exposure pathways associated with groundwater, even if it has been impacted by site contaminants.

5.3 Air Exposure Pathways

Chemicals in soil can migrate to the atmosphere through volatilization or suspension of soil particles. Chemicals that may be involved in both of these processes have been detected in soil and soil gas samples at the Fire Valve Area. The presence of a receptor who might inhale the resulting airborne compounds would complete the soil-to-air-to-human exposure pathway.

Chemicals that sorb to soil particles can be released into the atmosphere through wind entrainment or by mechanical disturbance. Of the contaminants detected at the Fire Valve Area, the polynuclear aromatic hydrocarbons (PAHs) tend to sorb to soils and could potentially be released into the atmosphere. Wind, however, does not represent a method of contaminant transport at the Fire Valve Area because PAHs have been detected at depths greater than two feet below ground surface and would not be subjected to wind erosion. On the other hand, utility line maintenance workers may cause the release of dusts during excavation or other soil handling activities. Inhalation of airborne dusts may therefore represent another complete exposure pathway for these workers. It should be noted, though, that PAHs were detected in only one soil boring and may represent a minor source of contaminants potentially released at the site.

At least two volatile compounds typically associated with fuels were detected in soils at the Fire Valve Area: ethylbenzene and xylenes. Volatile compounds may be emitted from soils as airborne vapors. Considering that the volatile compounds were found at relatively low levels and any vapors released at the soil surface will probably be rapidly diluted in the atmosphere, it appears that vapor releases may represent a potentially complete, but inconsequential exposure pathway. Once again, though, the utility line maintenance worker may be exposed to somewhat higher vapor levels because of subsurface excavation activities. The relatively low levels of volatile compounds detected in subsurface soils suggest that this exposure pathway may be minor or essentially incomplete.

5.4 Surface Water Exposure Pathways

Whenever chemicals of potential concern are detected in site soils, the potential exists for surface water to be impacted by surface runoff. Surface drainage from the Fire Valve Area flows from the asphalt southwestward to a grassy, drainage swale running along the northeast side of Corkill Road. During rainfall events, runoff from the swale flows into the 18-inch, corrugated metal storm sewer and to Scope Creek approximately 700 feet southeast of the site. Scope Creek is an intermittent stream that flows to the northeast and becomes perennial in the northeast part of the Base. Scope Creek merges with several other intermittent streams to form the headwaters of the Little Blue River approximately two miles from the site. Drainage patterns on the Base consist of a combination of open channels and closed drainage systems. The closed systems include pipes ranging in diameter from 18 inches to 66 inches. All Base stormwater drains into Scope Creek.

The Little Blue River is also intermittent until it merges with Oil Creek, approximately 2.5 miles downstream from the site. The Little Blue River has been dammed approximately seven miles from the site to form Longview Lake From the headwaters in Section 36, Township 47 North, Range 33 West to Longview Lake, the Little Blue River is a Missouri Class C stream and is designated for use as livestock and wildlife watering, and for protection of warm water aquatic

life and human health from fish consumption. A Class C stream is one which "may cease flow in dry periods but maintains permanent pools which support aquatic life" (Rules of Department of Natural Resources, Division 20 - Clean Water Commission, Chapter 7 - Water Quality, March 4, 1991). The Little Blue River, which flows northward and eventually discharges to the Missouri River, is not listed as either an Outstanding State Resource Water or an Outstanding National Resource Water; it is listed as a Metropolitan No Discharge Stream.

There are several reasons why surface water is not likely to contribute to a complete exposure pathway.

- Runoff that exits the Fire Valve Area is transported by a storm sewer to Scope Creek, 700 feet from the area; however, soils were not contaminated at the surface thereby eliminating the potential for contamination to migrate via runoff.

- Intermittent streams such as Scope Creek are not considered to be surface water in areas with greater than 20 inches of annual rainfall

- The nearest water bodies are Longview Lake and a small pond, respectively, seven miles and one-half mile from the Fire Valve Area.

On the basis of these factors, surface water exposure was considered to be incomplete for the Fire Valve Area and no further evaluations of this exposure pathway were conducted.

6.0 RISK EVALUATION

Potential risks associated with the Fire Valve Area are evaluated in this section. Potential Applicable or Relevant and Appropriate Requirements (ARARs) are discussed in this section also. A qualitative risk evaluation was conducted to provide a determination whether contaminants detected at the Fire Valve Area pose risks to public health and the environment. Potentially complete current and future exposure pathways have been identified based on the current understanding of site conditions.

6.1 Conceptual Site Model

A conceptual site model was prepared that identified current and future potential contaminant migration routes and exposure pathways for the Fire Valve Area based on the site information obtained during this PA/SI. The contaminants identified during the investigation include TPH, xylenes, ethylbenzene, and PAH compounds. The maximum concentration of these compounds are shown on Table 3, which indicates TPH concentrations in soil reached 370 ppm while only trace amounts of total xylenes, ethylbenzene, and PAHs were detected in soil. Groundwater and air were not sampled. The source of contamination is not known but is thought to be related to a past spill southwest of Building 605. Currently, there are no identifiable, potentially active sources of chemical releases in the area. However, contaminants in soil may represent a secondary, but apparently localized, source of contamination.

Table 3: Conceptual Site Model
Fire Valve Area, Site SS009, Richards-Gebaur AFB, Missouri

Site Desription	Soil Contaminants		Migration Pathway	Exposure Path/ Exposed Population	Preliminary Risk Evaluation
	Contaminant	Concentration			
Fire ValveArea Located on the south side of Bldg. 605. During excavation to repair an underground water main valve, petroleum product was discovered in trench. Contaminated soil was removed. However, additional soil contamination was identified within the water-line trench during the PA/SI.	TPH Total Xylenes Ethylbenzene PAHs	370 mg/kg 0.068 mg/kg 0.036 mg/kg 1.1 mg/kg	Leaching of contaminants from soil to groundwater; contaminated soil is possible source.	Potential ingestion of contaminated drinking water; groundwater on site is not currently used for any purpose; pathway incomplete.	Groundwater Pathway incomplete as groundwater is not a source of drinking water; however, groundwater contamination needs to be determined. May exceed ARARs.
			Contaminants spread by surface water runoff.	Potential incidental ingestion, dermal contact, and inhalation; pathway incomplete.	Surface Water Pathway incomplete; surface water not impacted by site.
			Soil; contaminated Soil becomes a source.	Exposure to contaminated soil by utility workers via incidental ingestion, dermal contact, and inhalation.	Soil Pathway complete if maintenance conducted on water line.
			Air: contamination volatilizes or suspension of soil particles.	Exsposure to dust or volatiles by utility workers via inhalation.	Air Pathway incomplete; ion concentrations of volatiles easily vaporized in atmosphere.

* Maximum concentrations detected during PA/SI (March 1994).

Potential contaminant migration pathways were evaluated in the previous section for four environmental media. The potentially complete and incomplete exposure pathways associated with these environmental media are briefly reiterated below. Soil contamination in the Fire Valve Area occurs only in the subsurface, greater than three feet deep. The typical onsite worker is not likely to contact these soils and be exposed to contaminants, and that potential exposure pathway is incomplete. However, utility workers conducting maintenance along the water line could potentially contact subsurface soils and be exposed to contaminants. Exposures could occur as a result of incidental soil ingestion, dermal contact with soils, and inhalation of airborne dusts. Furthermore, volatile contaminants may be emitted from subsurface soils and result in the exposure of utility workers to airborne vapors. These exposures are likely to be infrequent and of short duration. The underlying groundwater system at Richards-Gebaur AFB requires further investigation to determine whether the groundwater has been contaminated by releases in the Fire Valve Area. However, since the water table aquifer is not a source of drinking water, a complete exposure pathway does not currently exist.

Surface water in Scope Creek may not be impacted by overland flows originating from the Fire Valve Area. Also, since the stream is intermittent, any contaminated groundwater discharges to the creek are probably inconsequential. Thus, it does not appear that contaminants may reach a surface water body and there are no complete exposure pathways associated with this environmental medium.

6.2 Identification of Applicable or Relevant and Appropriate Requirements

The CERCLA Compliance with Other Laws Manual describes how Federal and State laws are identified and applied to remedial actions at hazardous waste sites. ARARs are identified by first determining whether the requirement is applicable and, if not, then whether the requirement is both relevant and appropriate.

There are three types of ARARs: chemical-specific, location-specific, and action-specific. The potential chemical-specific ARARs identified for the Fire Valve Area are described in the following sections. There are no location or action-specific ARARs identified for this site.

6.2.1 Chemical-Specific ARARS

The chemical-specific ARARs set levels that are considered protective of human health and the environment for the chemicals of concern in the site media, or indicate acceptable levels of discharge for those chemicals, if discharge occurs as part of a remedial activity. If there is more than one requirement that is an ARAR for a chemical, then the remedial activity must meet the more stringent requirement. The media of potential concern identified at this time for the Fire Valve Area are the soil, and potentially the groundwater. The potential contaminant of concern for the soil and groundwater identified to date is petroleum; specifically, TPH. At present, no Federal chemical-specific ARARs for soils and sediments have been promulgated.

State of Missouri

Missouri regulations that are more stringent than or supplement Federal standards are also potential ARARs. The State has defined a release as any loss of product to the environment.

Spills from underground storage tank (UST) systems must be reported if they exceed 25 gallons; however, the contaminated soils in the Fire Valve Area do not appear to be a spill from an UST. The State of Missouri also provides action levels to indicate a release (TPH >25 ppm or BTEX >1.0 ppm or benzene >0.5 ppm); however, these values are not cleanup levels. Because the TPH concentrations detected in the soils exceed the action levels, there is evidence of a release. The State has generated a matrix for determining soil cleanup levels at UST sites requiring corrective action, and the levels for the Fire Valve Area are 200 ppm for TPH compounds, and for BTEX compounds the levels are 1 ppm, 5 ppm, 10 ppm, and 10 ppm, respectively. Only one soil sample exceeded the cleanup levels for TPH with a concentration of 370 ppm; none of the samples exceeded the BTEX levels.

Missouri has also proposed Any-Use Soil Levels (ASLs) for residential settings that provide maximum concentrations of hazardous chemicals in soils which are acceptable to human health. For the PAHs detected, anthracene and fluorene, the associated ASLs are 17,000 ppm and 2,300 ppm, respectively. None of the soil samples collected exceeded the ASLs for PAHs, and only non-carcinogenic PAHs were detected. The ASLs for BTEX compounds were not exceeded; ASLs have not been established for TPH compounds. Table 4 provides the soil cleanup levels for the State of Missouri and the maximum concentration of the contaminants detected.

Table 4
State of Missouri Soil Cleanup Guidelines for LUST Sites and Proposed Any-Use Levels

Compound	Maximum Concentration Detected (ppm)	Soil Cleanup Guidelines for LUST Sites[a] (ppm)	Proposed Any-Use Soil Levels[b] (ppm)
BTEX	ND/ND/ 0.036/0 068	1/5/10/10	170/11,000/ 5600/110,000
TPH	370	200	NA
PAH - Anthracene PAH - Fluorene	0.23 0 36	NA NA	17,000 2,300

[a] MDNR, 1992, Underground Storage Tank Closure Guidance Document.
[b] Missouri Register, 1992, Proposed Rule, 19 CSR 20-9 020 Any-Use Soil Levels for Residential Settings
ND: Not Detected NA. Not Available

6.3 Risk Characterization

Quantitative estimates of human health risks associated with the contaminants of concern are beyond the scope of the work for this PA/SI. Several potentially complete exposure pathways were identified in the Fire Valve Area and were associated with contaminants detected in soils. On the basis of these findings, it cannot be determined whether direct soil contact or the release of contaminants from soils represent potential health hazards. However, since the impacted areas are relatively limited and only low contaminant concentrations were detected in soils, it does not seem likely that direct soil exposure or inhalation of airborne dusts and vapors represent

substantial threats to human health. Also, since utility workers are likely to have infrequent exposures to soils and exposures may be of short duration, risks appear minimal for these workers.

In addition, there are no ARARs available for soils with the exception of the State of Missouri cleanup levels for leaking USTs and ASLs. Only one soil sample exceeded the cleanup level for TPH compounds at a depth of 4.5 feet below ground surface. None of the volatile or semi-volatile compounds exceeded cleanup levels.

7.0 SUMMARY

In summary, the source of the petroleum contamination in the Fire Valve Area appears to be related to a spill or release, possibly from past operations in Building 605. Based on the file review and records search, the petroleum contamination does not appear to be related to a leaking UST or above-ground storage tank (AST). As observed during field activities, the source of contamination does not appear to be related to the abandoned POL line either, as the contamination was not observed continuously along either the water line or gas line, and remained in the area of the Building 605. The petroleum contamination appears to be confined to a portion of the water line trench southwest of Building 605. The contamination was not continuous within the water line trench as contamination was only detected intermittently in some of the borings along the water line. The discontinuous nature of the petroleum contamination may be related to different spill events in the past.

The soil sampling program detected very low levels of ethylbenzene, xylene, and non-carcinogenic PAH compounds. Only one soil sample exceeded Missouri's LUST cleanup level for TPH, and the sample was collected at a depth of 4.5 feet below ground surface. The qualitative risk assessment identified utility workers conducting maintenance along the water line as the highest risk group in relation to the site's contaminants. However, the risk to this group would be minimal as maintenance would occur infrequently along the water line.

8.0 SELECTED ACTION: NO FURTHER ACTION

Based on the findings of the PA/SI, there are no significant impacts or risks to human health and the environment with respect to the soils in the Fire Valve Area. Therefore, a No Further Response Action regarding the soils in the Fire Valve Area is proposed. However, the groundwater underlying the site was not investigated as part of the PA/SI and further action is recommended to determine whether the groundwater has been affected by the contaminated soil identified during the PA/SI.

REFERENCES

Burns and McDonnell. 1993. Final Work Plan, Hazardous Material Storage Area Richards-Gebaur AFB, Missouri.

CH2M Hill. 1983. Installation Restoration Program Records Search. Richards-Gebaur Air Force Base, Missouri.

Gentile, R.J. 1984. Geology of the Belton Quadrangle. Missouri Department of Natural Resources. Report of Investigations Number 69.

Missouri Department of Natural Resources. 1991. Missouri Site Characterization Guidance Document. Environmental Services Program, Jefferson City, MO.

Missouri Department of Natural Resources. 1992. Underground Storage Tanks Closure Guidance Document. Division of Environmental Quality, Jefferson City, MO.

O'Brien & Gere. 1991. Remedial Investigation at Richards-Gebaur Air Force Base for North Burn Pit, site FT002; Oil Saturated Area, site SS003; Hazardous Waste Drum Storage, site SS004; and POL Storage Yard, site ST005. Prepared for: Department of the Air Force, Headquarters Air Force Reserve, Robins Air Force Base, Georgia.

Richards-Gebaur AFB Basewide Environmental Baseline Survey. December 1993. (No Author provided).

Richards-Gebaur AFB Disposal and Reuse PDEIS, Internal Working Draft. December 1993. (No Author provided).

U.S. Department of Agriculture. 1984. Soil Survey of Jackson County, Missouri. Soil Conservation Service in Cooperation with the Missouri Agricultural Experiment Station.

U.S. Environmental Protection Agency. 1988. CERCLA Compliance With Other Laws Manual. OSWER Directive 9234.1-01. Office of Emergency and Remedial Response, Washington D.C.

U.S. Environmental Protection Agency 1991. Guidance for Performing Preliminary Assessments Under CERCLA. PB92-963303. Office of Emergency and Remedial Response, Washington D.C.

U.S. Environmental Protection Agency. 1992. Guidance for Performing Site Inspections Under CERCLA. EPA/540-R-92-021. Office of Emergency and Remedial Response, Washington D.C.